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ON MALOCCLUSIONS OF THE DECIDUOUS DENTITION.*

By George Northcroft, O.B.E., L.D.S.R.C.S.Eng.

To those acquainted with the immortal works of Alexander Dumas, what romance is there not in the words "Twenty Years After." What visions are conjured up of fair women and gallant men, of anxious endeavour and shattered faiths, of honourable awards or evil deeds condemned.

It is perhaps difficult, Rudyard Kipling to the contrary, to believe that romance can be associated with the search after scientific truth, and yet can we not claim that our at one time little Society also has had its share of romance, with its triumph over difficulties, its solution of doubts, its ardent hopes and even illuminating failures?

Now the wheel has come full circle and with kindly courtesy and a most friendly gesture the Council have nominated, and you have elected me, "Twenty Years After," once more to preside over a Society since grown to maturity, a Society whose Transactions are read all over the world, but whose infant destiny was guided first of all by the wise counsels of the man whom all English and foreign orthodontists alike will soon be delighted to honour.

But however pleasant for the aged to indulge in sentimental retrospect, in these matter-of-fact days it has been decided, and perhaps most wisely, that a Presidential address must afford more solid pabulum for the scientific enthusiast, who must develop his wisdom by the mental trituration of hard and crusty fact, of tough and knotty problems, being unconfounded by the sweets of history or drawn from rectitude by the allurements of food only fit for babes.

In 1907 a paper was read before the Metropolitan branch of the B.D.A. recording twenty cases of irregularities of the deciduous dentition, and the opinion was then expressed that irregularities of the deciduous dentition were far more common than formerly had been taught, and the fallacy was condemned "that malocclusions of the temporary teeth are very rare and if present at all are found to affect the front teeth only." In the year 1910 a paper was published entitled "Some observations on the mouths of twenty-five children from $2\frac{1}{4}$ to $6\frac{1}{2}$ years of age." This paper sought to show that postnormality did not depend on the faulty occlusion of the first permanent molar but was probably developmental in origin and that all types of malocclusions were foreshadowed in the deciduous dentition. Text-book after text-book has continued to deny this latter contention, even down to one of the latest works which has won the considered approbation of those supposedly qualified to judge. But in this work the phraseology is somewhat altered, viz. "Although postnormal occlusion

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of the lower dental arch in varying degrees is fairly frequent in the deciduous dentition, few, if any, cases of crowding of the temporary teeth in early childhood have ever been recorded." In the *Lancet* the writer of the review of the above monograph draws attention to this paragraph and says that " the examination of a large number of children's mouths shows that definite crowding is far from uncommon though not so obvious." A statement with which most members of the B.S.S.O. will agree, but which has, perhaps, not been sufficiently " recorded." And although before this learned and progressive audience what follows may seem like " carrying coals to Newcastle," it would appear desirable that in this year of grace at least one more " record " should be made for the good of posterity.

Nearly " Twenty Years After " it is proposed to analyse another series of thirty young cases limiting the age to 4 years and 3 months, but with successional models where possible, in order that at any rate he who reads will not run again into the same error, and so that in another twenty years' time it can be said that it was owing to the insistence of the fact that irregularities *do* occur very early in the deciduous dentition that the way was shown to prevention by ameliorating developmental disabilities.

Proceeding then with an analysis of our thirty cases, which were taken just as they occurred in practice, one only is found in which there is really " ideal " occlusion. This must have been maintained from the age of 2 years, but when the war broke out the patient was only 9 months old and the elucidation of orthodontic problems seemed rather trivial and other calls were made on one's time, and the models at the age of three years were not made. It will be seen, however (Fig. 1) that even at age 4 years and 2 months the interdental mandibular spaces are still very marked, which seems to indicate that no forward translation has yet taken place, and also goes to prove that interproximal contact has been overstated as one of the primary factors in the development of ideal occlusion. All the other twenty-nine cases show more or less gross departures from this " ideal " condition. In placing this fact on record no use has been made of the rightness or wrongness of Dr. Friel's conception of the " ideal " molar occlusion at 3 years of age.

Omitting one " ideal," eight postnormal, two prenormal, three maxillary lingual and one mandibular lingual, there are fifteen cases which show more or less irregularity or crowding in the incisor region, often accompanied by excessive overbite.

It would be tedious to show slides of all these fifteen cases, but to emphasise the importance of recognising crowding of the deciduous dentition as prognostic of bone maldevelopment, the end result of some cases will be shown which have received no treatment.

Fig. 2. Female age 2 years and 4 months A pointed arch, marked overbite with maxillary laterals instanding and lower incisors retaining their developmental positions as stressed by J. G. Turner. Molar spacing good. At 7.4 note inlocked left maxillary lateral. At this age two months' treatment was undertaken and normal development took place.

Fig. 3. Same case as Fig. 2 at 8 and 9.1, showing result of two months' orthodontic treatment. Note closure of space between $\underline{1|1}$ and the eruption of $\overline{3|3}$.

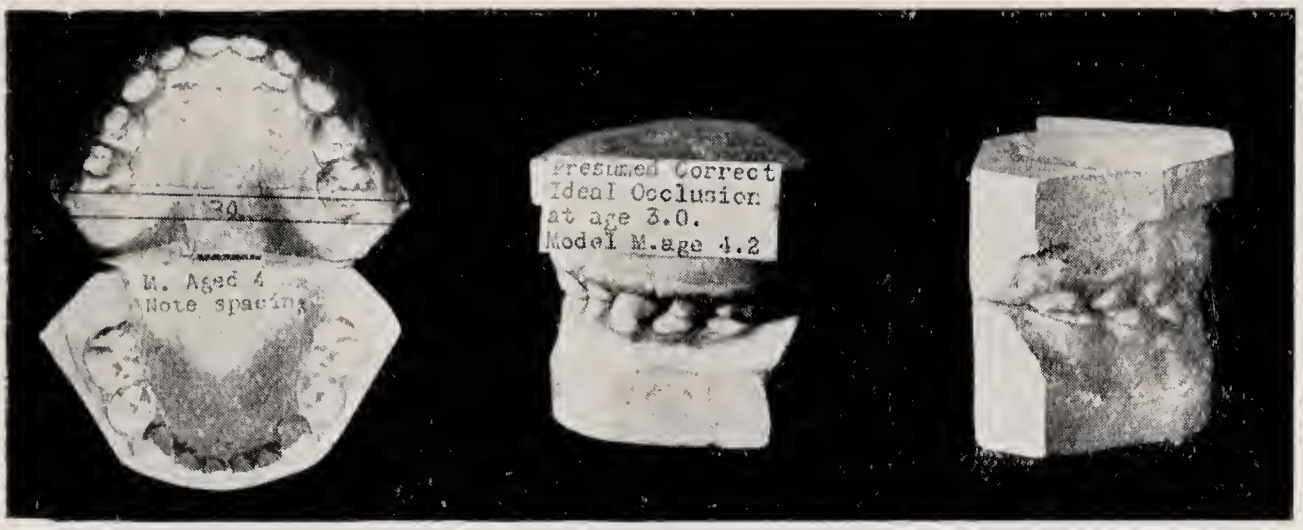


FIG. 1. The only ideal found, among 30 cases, from ages 2.4 to 4.3.

FIG. 2. Showing the ease with which early treatment can be accomplished successfully.

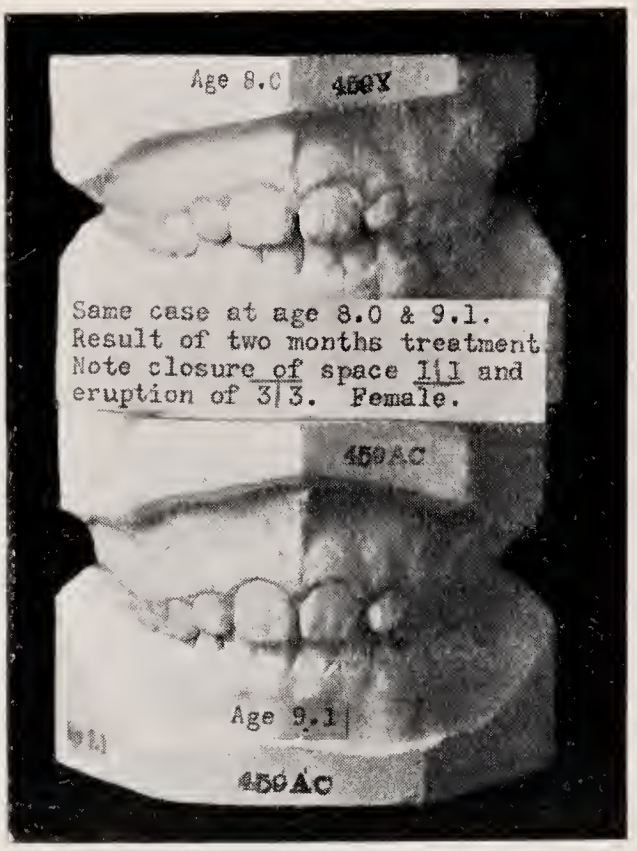


FIG. 3. Showing end result of Fig. 2 case, and two years after.

Fig. 4. Female age 4.6 contrasted with the "Ideal" brother, 4.2. Same environment, same heredity, different nurses.

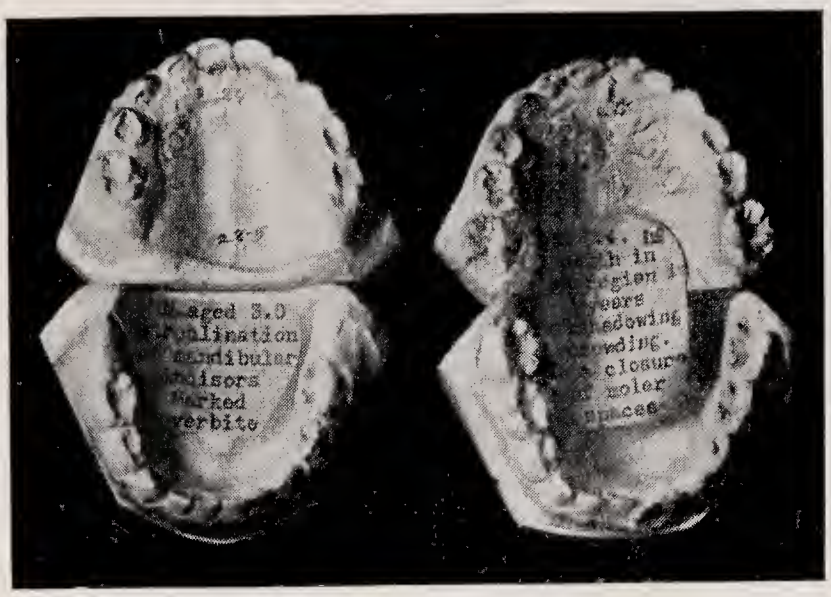


FIG. 5.

FIG. 6.

Fig. 5. Male, age 3 and 7.4, marked overbite, retroclination of mandibular incisors foreshadowing crowding. No development in four years in canine region also foreshadowing crowding. Note imbrication of mandibular incisors and closure of molar spaces.

Fig. 6. Same case at 17, with outstanding maxillary canines showing that lost palatal width has never been regained.

Fig. 7. Female age 3 and 8.9, small jaws, large teeth, incisal crowding, late development of $\underline{6|}$.

Fig. 8. Female age 3.5 and 7.3. Note persistent crowding in spite of 2.5 mm. growth in $\underline{c|c}$ region.

Fig. 9. Female age 4 and 8.2, superior proclination with spacing, mandibular crowding.

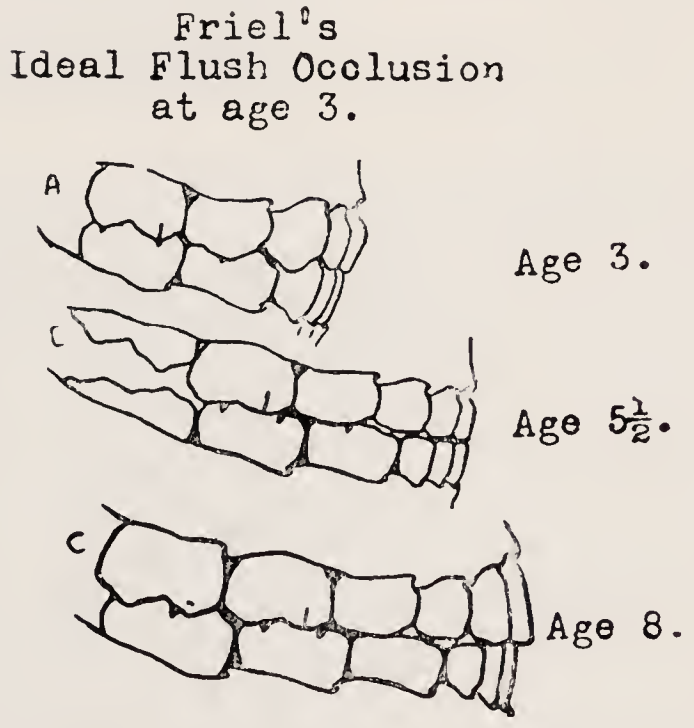
(Other models were shown, not illustrated here merely to demonstrate well-recognised types of malocclusion of the deciduous dentition.)

It is unnecessary to do more than state the fact that similar cases must be occurring every day, in every kind of practice, and if so, surely no more " records " are necessary to drive home the fact that all kinds of malocclusion of the deciduous teeth must be very common.

Enough models have been exhibited to emphasise and establish this " record," especially if taken in conjunction with Mr. D. M. Shaw's Dental Board Report for which purpose he examined eighty-five infants from 1 to 4 years old and found incisal overbite in 40 per cent. of the cases. Other abnormalities unfortunately are not mentioned.

Another point that has been brought out by this analysis is the necessity of a more intensive study of occlusion at the earliest ages before the problem of the " ideal " can be considered to be finally solved.

In a communication made to this Society in 1927 Dr. Sheldon Friel figures diagrammatically the second deciduous molars at the age of 3 years, displaying what has been called a flush occlusion (Fig. 10), explaining that only towards the age of $5\frac{1}{2}$ years does the posterior surface of the lower second deciduous molar take up a position forward of the posterior surface of the upper second deciduous molar, to enable the first permanent molars to occlude ideally. On June 17th, 1908, Harold Chapman read a paper to this Society in which he says " Each dentition is an entity in itself, the molar series of each being, comparatively speaking, the same." This implies that he believes in Friel's flush occlusion. In the discussion of H. Chapman's paper George Northcroft said, " he was inclined to differ from the author in considering the permanent and temporary dentitions as separate entities; he thought the temporary dentition and its occlusion controlled the permanent dentition a good deal more than the author acknowledged."



From an examination of the thirty cases from 2 to 4.3 it can be shown that Dr. Friel's and Mr. Chapman's generalisation is not correct. One repeats that the cases brought forward for study are in no way selected, a practice having been made over a number of years of taking models for every child who cheerfully submitted to this treatment.

In contrast to Dr. Friel's diagrammatic ideal, models are here shown in a presumed ideal occlusion (see Fig. 1), but in fairness to Dr. Friel it must be pointed out that the models shown as ideal are age 4.2, which is half-way towards his 5.6, the age at which he claims the second deciduous molars arrive at the positions here shown. But Dr. Friel's diagram is obviously drawn from teeth as seen in skulls with the soft tissue removed, and the backward slope of the teeth beneath the gum is not sufficiently obtuse.

In support of the contention that flush occlusion is not ideal for age 3 years, the first twenty-four cases of the lowest ages from 2 to 3.9 have been chosen for analysis, and in six or 25 per cent. the mandibular teeth are in postnormal occlusion; in one the mandibular incisors are in prenormal occlusion, in three the maxillary molars are in lingual occlusion, and in one the mandibular molars are in lingual occlusion.

This leaves thirteen cases to be considered, of which two are flush on one side and ideal on the other, and of the remaining eleven one is doubtful, five are flush, but in one of these the lower canines are post-normal, and therefore it would naturally follow that the lower molars take up a position too far back, leaving five, or roughly 40 per cent., with the posterior surface of the $\frac{e}{e}$'s distinctly posterior to that of the $\frac{\overline{e}}{\overline{e}}$'s. Two of these cases display this condition as early as 2 years 4 months and 2 years 7 months (Figs. 14 and 15).

Following up the after condition of these cases, only one of the flush occlusions becomes normal, but with very marked imbrication of the incisors at age 13, one becomes postnormal and the other three show no forward movement of the lower molars at age 5, which would seem to indicate that these also would become postnormal, although unfortunately models at 7 years old are not available. Of the five presumed normal four occlusions become normal antero-posteriorly after the eruption of the first permanent molars, the fifth case being dealt with later. It may be fairly argued, therefore, that to say the least, Dr. Friel's contention is open to doubt and needs revision.

A more minute analysis of one or two cases may be of interest, but the said cases are scarcely germane to what has gone before.

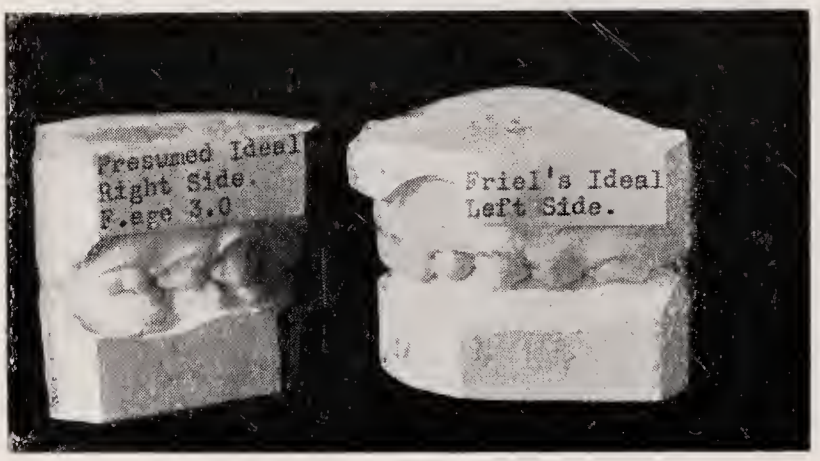


FIG. 11.

FIG. 12.

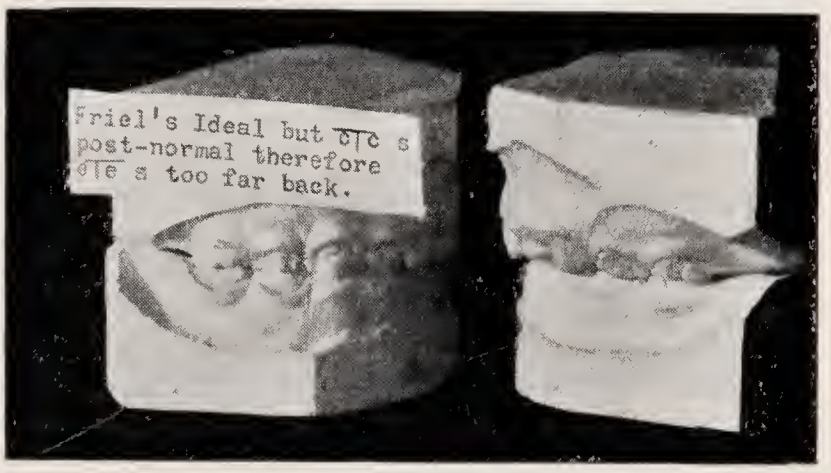


FIG. 13.

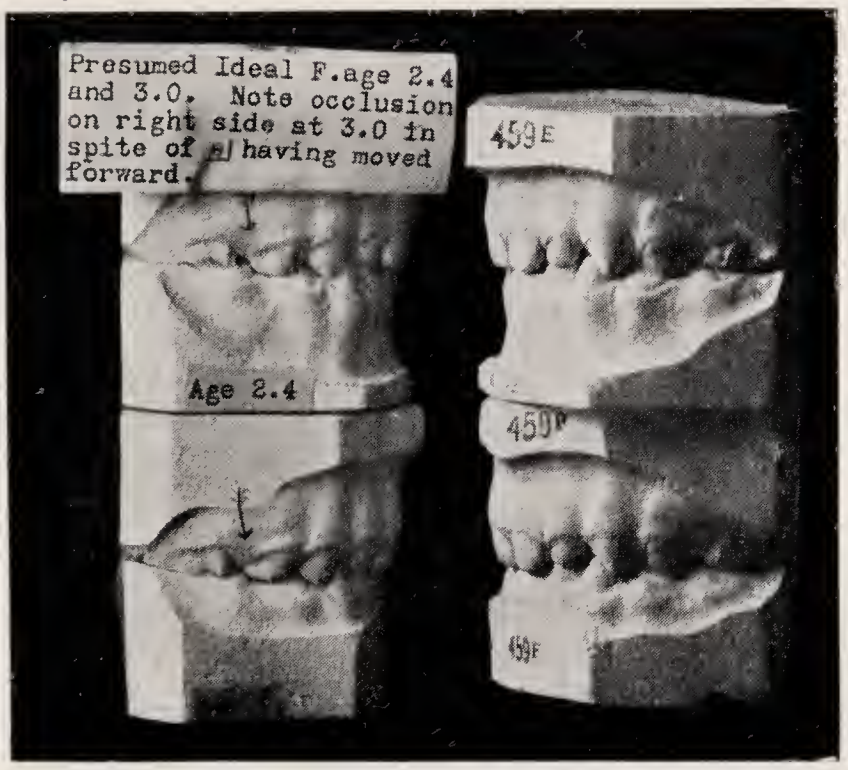


FIG. 14.

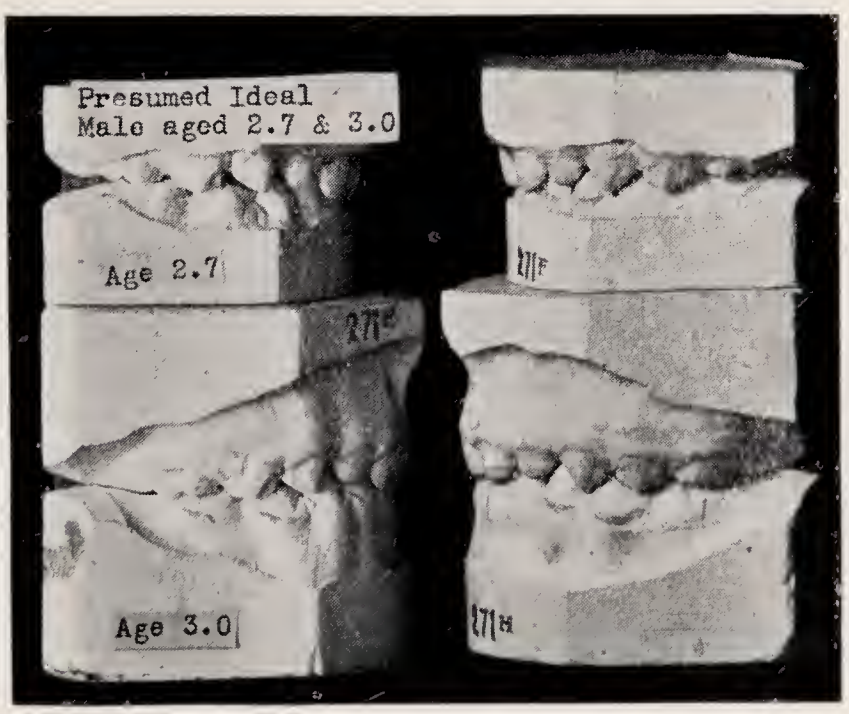


FIG. 15.

FIG. 16. Normal occlusion at age 3.7 becoming gradually post-normal due to lack of correlation of growth of maxilla and mandible.

Male, age 3.7, seems an instructive case showing that Class II, Division 2, probably begins manifesting itself at a later date than Division 1, emphasising how different deformities are correlated to different physiological age groups. This case shows molar occlusion good, marked spacing, slight overbite, rotated maxillary laterals, but *no attrition* at age 7, which, according to Friel and other authorities, must occur as the mandibular molars move forward under normal conditions. There is no crowding in the molar region (note erupting $\frac{6}{}$ |), but there is a gradually increasing overhang of the maxillary alveoli. Now note differences of rate of growth in the two developing jaws, the maxilla has increased in canine width only .5 mm. and the mandible has increased 2 mm. in the corresponding region, with *no attrition*. The only possibility is for the mandible to take a backward position to obtain comfortable articulation.

This observation revives the old theory of the bite of convenience as an etiological factor.

Later this case, quite untreated, became a very marked post-normal one with outstanding maxillary laterals. The models taken at 17 were given away.

Another curious case is one in which attrition *has* occurred, presumably demonstrating the action of complete " function " and again showing how little this factor can dominate development, for in this case left unilateral postnormal occlusion of the mandible has occurred, but the reason is still to seek.

The main object of this address is to point out that certain observations concerning malocclusion of the deciduous dentition believed to be true were made before this Society existed. Now, more than " Twenty years After " this Society has been established, in spite of contradictions, it is sincerely hoped that at least this audience has been persuaded to believe that those observations were accurately made and the deductions therefrom well founded.

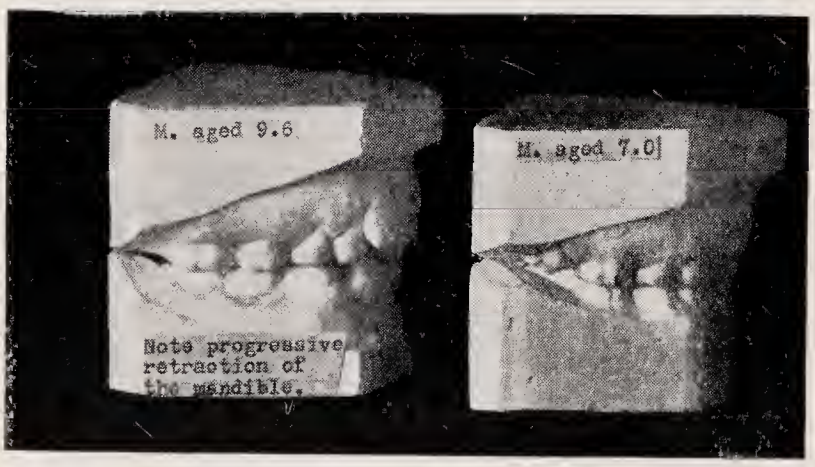


FIG. 17.

FIG. 18.

Discussion.

Mr. A. T. Pitts said it would be very ungracious if the members did not avail themselves of the opportunity to discuss the President's address —which was generally conceded to be free from criticism. Looking back over the time he himself had practised, he realised that had he depended on private practice he should have known practically nothing about the deciduous dentition, because a very small fraction of the children coming to see him had been much younger than 4 years of age. He also realised that had he depended on his experience on the staff of the Royal Dental Hospital he would have known comparatively little about the deciduous dentition in its beginnings, because the majority of children who came to see him there were generally of the age of 7 or over rather than 2 or 3. During the time, however, he had been associated with Great Ormond Street Hospital (for over twenty years) he had been able to see a very large number of children of under 4 years of age, and whatever he might know about the deciduous dentition he had learned there. He realised now that, for the orthodontist who was anxious to know the beginnings of malocclusion, even the dental department of a children's hospital did not get children early enough in age, and he was certain that one could spend profitable years at a child welfare clinic, where babies were seen almost from birth. He was entirely unable to understand how the old bogey—that malocclusion of the deciduous dentition was extremely rare—had crept in. Surely the explanation must be the old parable of eyes and no eyes : people had not seen it because they had not looked for it, but it was there. He saw it in abundance every week when he went to Great Ormond Street. He thought every type of malocclusion of the permanent dentition could be paralleled in the deciduous dentition—with one exception ; he had not yet been able to see an authentic example of what Angle would term Class II, Division 2—post-normal occlusion with a retroclination of the upper central incisors, though he had looked for it very hard. The closest he had seen to it was in a child who had a cleft palate, and he thought that case must be ruled out. He had seen many cases of what Angle would term Class II, Division 1 in children of two to three years of age. Pre-normal occlusion, however, was distinctly rare. With regard to the ideal occlusion, of which the President had spoken, he must say that his own observations led him to agree with the President that the usual occlusion in a child of two to three years of age was not a flush occlusion as described by Friel, but the type of occlusion which the President had shown on the screen. After what the President had said, it seemed to him that it should surely be impossible for anybody to make the statement that malocclusion in the deciduous dentition was rare. Naturally it was not so striking or obvious as in the permanent dentition. It showed that they must put the time when irregularities of the teeth and jaws developed further back even than they thought, and he believed himself that many of those conditions must have been initiated within the first few months of life.

Mr. Norman G. Bennett remarked that Mr. Pitts had said that Angle's Class II, Division 2 was the only kind of malocclusion which did not exist, or which only rarely existed, in the deciduous dentition. His (the speaker's) daughter, who was now 22, had possessed it at the age of 3. There was this difference between the permanent dentition and the deciduous, that in the permanent dentition what was usually seen was a retroclination of the centrals with the laterals more or less in their normal position, or perhaps somewhat proclined ; whereas in the deciduous dentition all four incisors were usually retroclined. In the case of his daughter there had been a definite post-normal occlusion of one unit, and a deep overbite ; and all the upper incisors were in the position of retroclination and practically in contact with the lower incisors, which formed part of an arch in the lower jaw, which, taken by itself, would have appeared to be

normal. With regard to the President's Address, of all the examples shown the easiest to remember was the last one, and he had been very much struck by that case, because, as the President had said, it was, in the early stages, one of those cases in which one would expect, with wide arches and spacing, a normal occlusion to develop. He had been wondering whether the President had any models or knowledge of the patient after the age of the last model, which, he thought, was at the age of 8, because he should rather expect that the occlusion would eventually become normal instead of being post-normal to the extent of half a unit.

Dr. SHELDON FRIEL remarked that in a paper which Schwarz had recently given in Vienna he had put forward a large number of instances of skulls where there was a flush occlusion—the lower teeth bulging out beneath the gum, which the President had said was not the true position. Personally, he was quite willing to make further inquiry into the matter and see what the position was. In some of the President's cases he did not think the occlusion was morphologically correct. In one case—Slide 16—the upper secondary deciduous molars seemed to be rotated. It was, however, difficult to be sure what one saw on a slide which was only on the screen for a few seconds. He had a very large number of models which had been taken from year to year of school children, and certainly as far as he could judge the lower deciduous molars in the normal cases had come forward—in cases where there had been attrition; but where there had been no attrition the clogging was so great that they could not come forward, and it seemed to lead to a temporary post-normal relation of the permanent molars, but not to a permanent post-normal relationship. What was got permanently, however, was a close bite. The permanent molars came forward after the loss of the second deciduous molars. The lower one came further forward then the upper one, and in that way they locked correctly, but there was apparently left a close bite. As far as he could see, most normal cases possessed a spacing in between the lateral and canine in the permanent dentition, and when that was not present it meant that the lower jaw had not come forward to the full amount it should have at 6 years of age, and one was faced with a close bite. The case of attrition certainly was astonishing, but he agreed with Mr. Bennett that it would probably come right. He also had had one case of Class II, Division 2 in a child 6 years of age, with all the upper teeth leaning backwards and all in contact with no irregularity in the form of the arch, except that they were all lingually inclined. Perhaps when the address was published he might be able to say more about the flush occlusion.

Mr. MAXWELL STEPHENS then proposed a very hearty vote of thanks to Mr. Northcroft for his Presidential Address, which was carried with acclamation.

The PRESIDENT, in acknowledging the vote, said there was one thing he would like to say in reference to Dr. Friel's remarks, and that was that the convexity of the back of the mandibular deciduous molar was much less than that of the maxillary molar—the posterior surface of the second mandibular deciduous molar was flatter than the upper one. He believed this was anatomically correct. There was less " bulge " on the lower than on the upper.

SOME CASES OF DELAYED ERUPTION OF THE TEETH*

By J. Lewin Payne, M.R.C.S., L.R.C.P., L.D.S.

The subject of eruption of the teeth has given rise to many speculations and theories, both as to the process itself and how it is brought about. Even to-day, in the twentieth century, we are not exactly clear as to what happens when a tooth moves from the position in which it was developed into that in which it can perform the function for which it is intended.

If we look back into early Dental Literature, we find a relatively large amount of space devoted to this question, which was dealt with under such titles as "Dentition," the "Breeding of Teeth," or as Thomas Berdmore described it—"the Sprouting of the Teeth." Yet in spite of all the literature that has been written and the many efforts of physiologists and histologists to explain the process, the mechanism by which teeth find their way into the correct position, and stop there, is far from being perfectly understood. It would seem that the most hopeful directions for seeking a clue are to be found in investigating the growth of the jaws, and the movements of teeth in the lower orders of the vertebrate kingdom and by comparing the effects of various pathological conditions upon the manner in which teeth erupt.

I shall endeavour to guide your thoughts in the latter direction whilst describing some of my cases to-night.

It is not my intention to discuss the various theories that have been advanced to explain the eruption of the teeth, still less do I propose to put forward any new theory. My purpose is to demonstrate the results of some pathological conditions, and to bring to your notice one remarkable series of cases, as well as some individual examples, in which delay has occurred in the eruption of the teeth. Others will be shown where the teeth have remained buried in the jaws and show no evidence of any attempt to reach the surface.

Let me begin by referring briefly to a few of the more common instances in which individual teeth fail to reach their proper level in the alveolar arch at the normal time of eruption.

Some cases of delay may be due to mechanical causes. This view seems to be supported by the fact that the teeth which are most frequently late in eruption are those which meet with obstruction in finding their way into the arch.

For example, canine teeth have to travel some distance from the area where their development commences, and in order to reach their normal position they must pass between the lateral incisor and the first premolar. Such obstruction frequently leads to displacement of the

* *Transactions* of British Society for the Study of Orthodontics, February, 1929.

upper canine. The crown of the tooth becomes diverted and it may erupt, after some delay, either on the buccal or on the palatal aspect of the arch; or, in some cases, the point of its cusp is turned towards the middle line, and the tooth remains lying almost horizontal to the alveolar border. Such cases are familiar to all dental surgeons. On rare occasions the canine has been found pointing into the nasal fossa, or beneath the chin.

One could show many examples of retarded eruption in connection with canines, but I shall illustrate this point with one case only.

Figure 1 shows a radiogram from a male aged 46, who presented himself, with a sinus in the right upper canine region. A dilacerated and rarefied lateral incisor lay just beneath the surface of the jaw and the corresponding canine tooth was lying obliquely above it.

I would suggest, as a possible cause of this particular condition, that the injury which caused the dilaceration of the lateral incisor diverted the canine tooth from its normal position and led it to move horizontally.

Second premolars are liable to meet with obstruction through having to erupt between teeth already in place; and even when the mechanical obstruction has been removed they may fail to erupt because absorption of the alveolus does not take place. Fig. 2 illustrates such a condition.

The presence of supernumerary teeth frequently delays the eruption of the normal members of the series.

Another type of mechanical obstruction is that found in the third molar region. This applies especially to the lower third molar, which, in consequence of lack of space between the second molar and the anterior border of the ascending ramus, remains impacted, or is often diverted from its normal course.

Even when the obstruction is removed by extraction of the second molar the buried member of the series may fail to erupt because alveolar absorption over the crown of the tooth is no longer active, but we all meet with cases where the pressure of a denture seems to stimulate fresh activity, and to bring the tooth to the surface. Quite recently I have seen two such cases where the lower third molars were found erupting at the ages of 65 and 70.

Now I pass on to some examples which represent less common conditions.

Fig. 3 shows the model, and Fig. 4 the radiogram, of a case of an upper second molar lying beneath the gum and wedged between the roots of the first and third molars. I have seen several cases of this nature.

The next example is one of peculiar interest, inasmuch as all the first molars lie deeply buried in the jaws. The patient (G.D.) was a boy aged 13. He was sent to me for consultation at the dental department of Guy's Hospital because of a swelling which could be felt below the mandible in the right molar region. It was a hard, localised swelling. On examination, the right lower first molar was observed to be missing from the mouth and no definite history of its extraction could be obtained from the patient. (Fig. 5.) The other first molars could be seen, but they were incompletely erupted. The right

Upper Canine.

Fig 1.

Fig. 2.

Fig. 4.

Fig. 5.

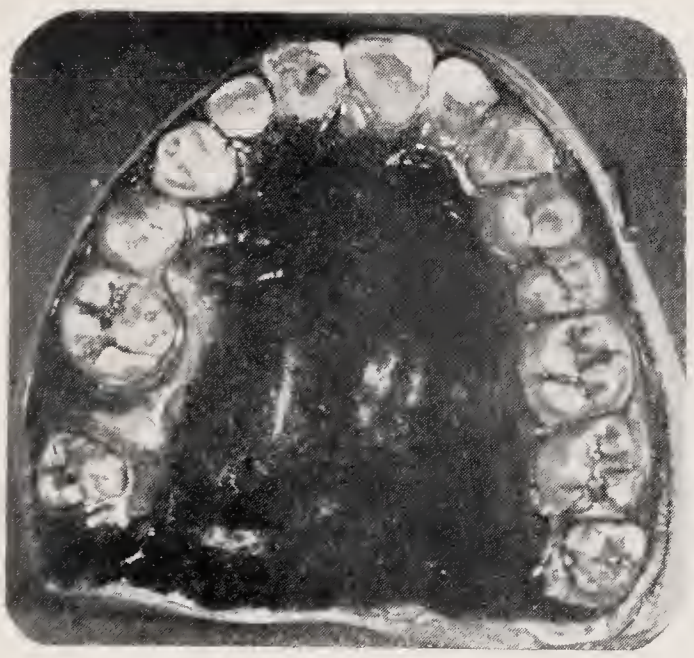


Fig. 3.

Fig. 1. Deeply placed right upper canine above a dilacerated and rarefied lateral incisor in a patient aged 46.

Fig. 2. A left lower second premolar lying unerupted with its apex close to the basilar border of the mandible in a patient aged 42.

Fig. 3. Model showing gap for unerupted right upper second molar.

Fig. 4. Radiogram of case shown in Fig. 3 with the second molar wedged between the roots of the first and third molars.

Fig. 5 shows the models of the mouth of G. D., aged 13, whose first molars were all incompletely erupted.

lower second molar and the second premolar were tilted towards one-another and there was but a small interspace between their crowns.

Radiographic examination showed the first lower molar lying deeply buried between these teeth. It had a carious crown and a bent anterior root. (Fig. 6.) This tooth was removed, under a general anæsthetic, by cutting away a "window" of bone from the outer side of the jaw and by subsequently grasping the tooth with bayonet forceps.

Fig. 6.

Fig. 7.

Both roots of the tooth (Fig. 7) were grooved to allow for the inferior dental vessels and nerves with which they were in close proximity. Considerable hæmorrhage hampered the operation. The socket was tightly packed with gauze for forty-eight hours and subsequently irrigated with normal saline and eusol lotions.

Fig. 8 shows the condition of the jaw five weeks after the operation.

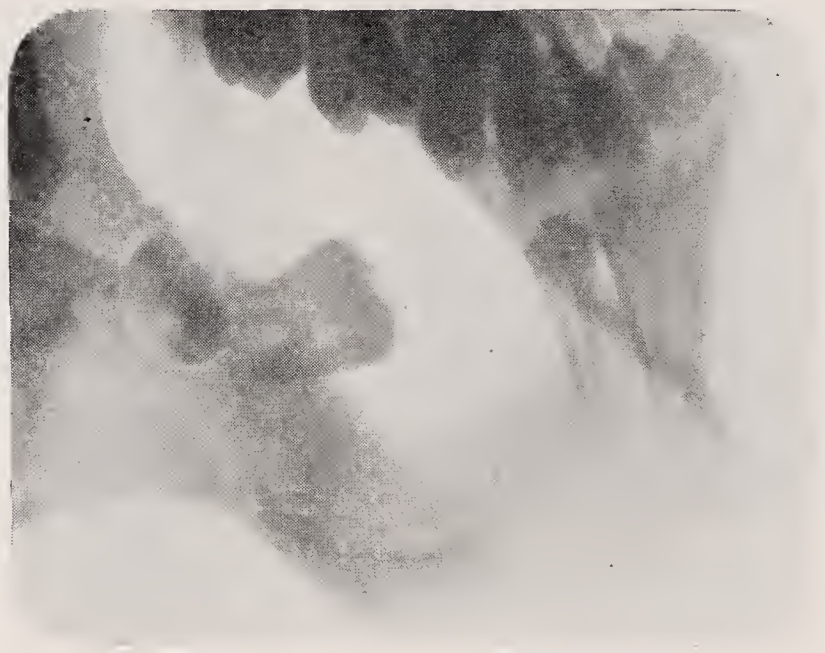


Fig. 8.

Fig. 6. (G.D.). Radiogram of the right side of the mandible showing the deeply buried first molar and an area of osteitis at the basilar border of the bone.

Fig. 7 shows the right lower first molar of G. D. after removal. There is definite evidence of caries in the crown and the roots, in addition to being dilacerated, are grooved for the inferior dental vessels and nerves.

Fig. 8 shows the condition of the mandible of G. D. five weeks after the operation.

Fig. 9 shows the position of the first molar on the left side (G.D.).

Fig. 9.

At first I was rather puzzled by this case and wondered why all of the first molars should be delayed in their eruption and why they should have dilacerated roots. Subsequently, I ascertained that the patient had had his tonsils removed when he was about seven and a half years old, under a general anæsthetic, and it seems reasonable to suggest that a gag used for opening the mouth might have driven the molars back into the jaw. The dilaceration of the roots appears to have taken place about that period.

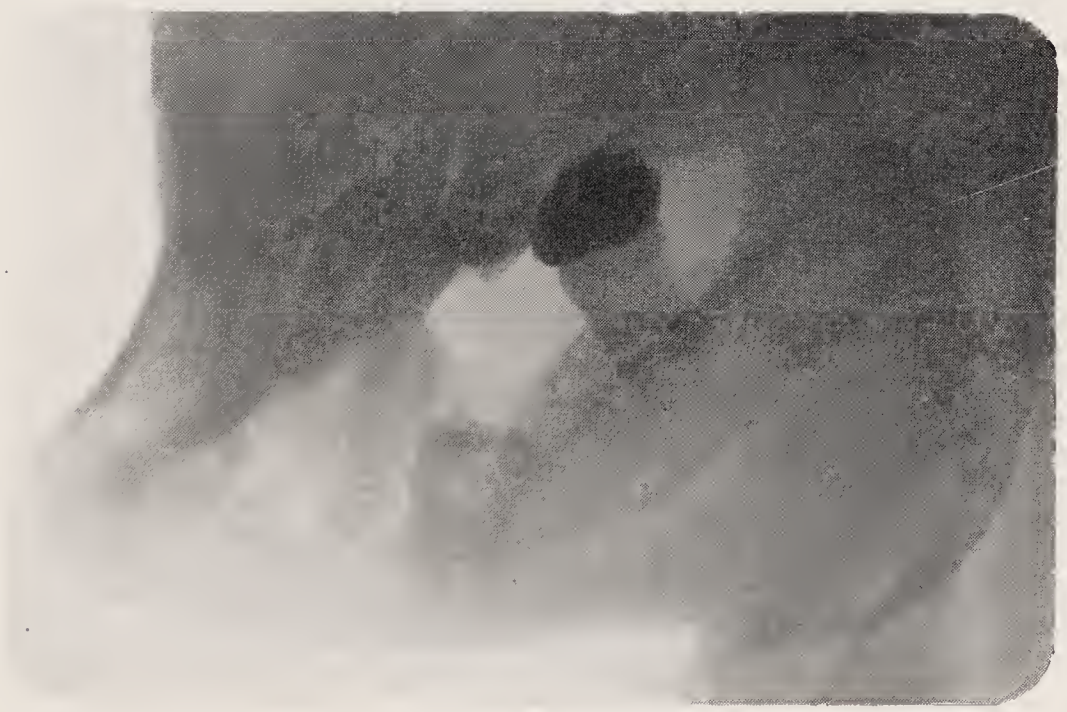


Fig. 10 (M.M.). Showing lower second molar lying deeply situated in the mandible.

Another case of an incompletely erupted and deeply buried molar occurred in a man (M.M.) aged 37. Fig. 10.

The patient came to see me at Guy's Hospital complaining of an unpleasant taste, accompanied by swelling and discharge from the right lower second molar region. On examination, a sinus was found, and with a probe a portion of a buried tooth was detected. An X-ray film showed the right lower second molar, with a very carious crown, lying deeply situated below the alveolar border.

An operation, similar to that referred to in the last case, was performed, but the crown of the tooth was fragile and the roots had to be divided and extracted separately. Once again, considerable hæmorrhage occurred, and for several days after the operation, anæsthesia of the lip and the front part of the jaw was experienced by the patient.

Recently I saw another man, aged 37, whose mandible showed lack of alveolar growth and the molars were incompletely erupted. This had resulted in an open bite at the back of the mouth.

The next series of cases to which I wish to call your attention is the most remarkable of all. It consists of a number of patients—most of them related to one another—who have been suffering from that strange complaint known as hereditary cleido-cranial-dysostosis, a name which was given to the disease by Comby in 1904. Although the symptoms were described by Morand as early as 1766, it is only within the last 50 years that the hereditary character of this disease has been established. Duncan Fitzwilliam, of St. Mary's Hospital, recorded 60 cases in 1910, and Dr. Percy Stocks gives a full account of the disease in his "Hereditary Disorders of Bone Development" (Cambridge University Press, 1925). It is a condition which affects those bones that are developed wholly or partially in membrane.

In nearly all the cases of this complaint that I have examined, the eruption of some of the teeth has been delayed, and this symptom has been observed in a large number of the 141 cases which have been recorded by various medical practitioners.

The general signs met with in cleido-cranial-dysostosis are—a large squarish head with straight forehead and flattened vertex. Prominent frontal eminences are observed and the nasal bridge is flattened and broader than normal. The head as a whole is markedly brachycephalic. (Fig. 13). The anterior and posterior fontanelles are disproportionately large and frequently remain open until adult life; the middle frontal, fronto-parietal, interparietal and parieto-occipital sutures can often be felt. Ossification of the cranial bones is both deficient in quantity and defective in quality. A large portion of the vertex remains in a membranous condition during infancy.

The two sexes appear to be affected about equally. One or both of the clavicles is deficient, or may be entirely absent, and there is a flattening of the infra-clavicular regions. In consequence of this deficiency of the clavicles the patient is able to approximate voluntarily the two shoulder blades towards the middle line in front, (Fig. 11) and to compensate for the loss of the clavicular attachment of the sterno-mastoid muscle, the anterior portion is well developed.

You will recall the fact that the clavicle is the first bone in the human body to become calcified; and that calcification occurs next in the mandible, and then in the maxilla. The extremities of the clavicle

Fig. 11.

At the time of going to press we had not succeeded in ascertaining the conditions under which this photograph was originally published and we have therefore not been able to obtain the necessary permission to reproduce it.

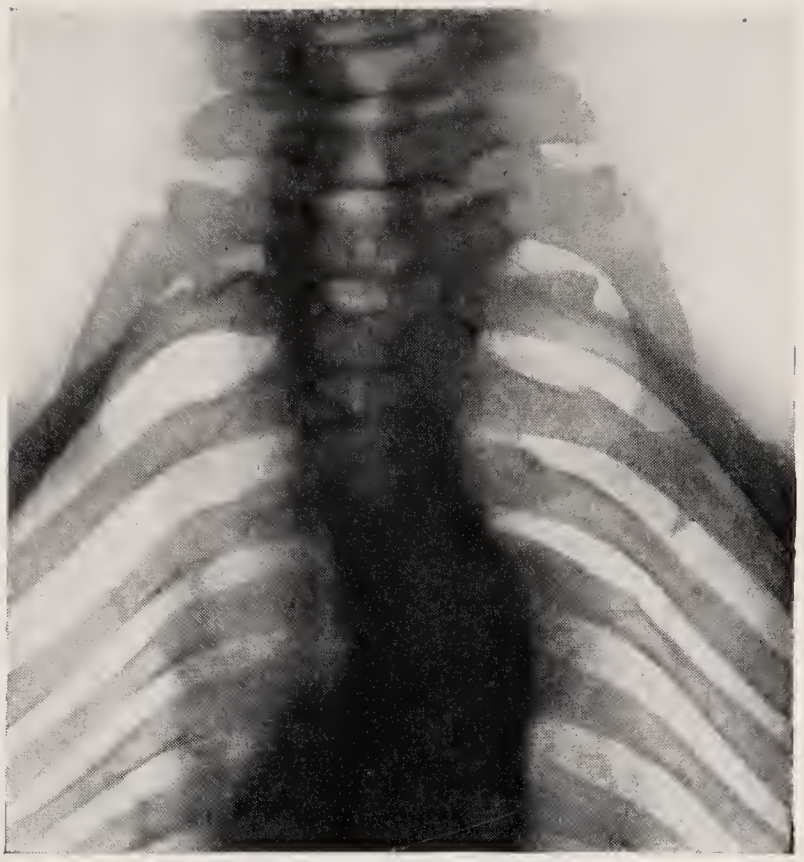


Fig. 11.

Fig. 12.

Fig. 13.

Fig. 11 (from Dr. Percy Stocks' work "Hereditary Disorders of Bone Development," published by Cambridge University Press) illustrates two children suffering from hereditary cleido-cranial-dysostosis whose shoulders have been brought together in front of the chest.

Fig. 12. Radiogram of the chest of C. E. S., aged 46, showing deficiency of both clavicles.

Fig. 13 (C. E. S.). Radiogram showing the shape of the skull, unerupted incisors in the maxilla, and unerupted incisors and canines in the mandible.

are derived from cartilage, whilst the shaft is developed in membrane. Spinal curvature is common in these patients. (Fig. 12.)

Cleido-cranial-dysostosis affects all the bones which are developed in membrane, and that is why the mandible, maxilla, as well as the cranial bones and the clavicles are involved in this disease. It may be contrasted with achondroplasia which affects bones that originate in cartilage. These diseases throw some light upon the developmental origin of bones, and it has been suggested that both affections are due to the presence, or absence, of certain chemical constituents which are necessary for correct ossification and may be looked upon as deficiency diseases.

In cleido-cranial-dysostosis the face presents various malformations. The mandible usually projects so that the lower teeth protrude beyond the upper incisors. The lower lip is prominent and this is more marked because the upper lip is small. It is generally agreed that the jaws are narrow and the palate high, and the teeth overcrowded, but some of the cases that I have seen do not confirm this statement. The maxillæ are poorly developed whilst the gums are often hypertrophied. Delay in eruption of the teeth appears to be an almost constant factor, and has been attributed to the restriction of the developmental area of the teeth, through the stunted growth of the jaws, which has been brought about by interference with the calcium metabolism. Briefly, hereditary cleido-cranial-dysostosis may be described as an arrest of development of individual parts of the embryo at a certain stage, with continued development of the remainder.

I will now throw on the screen a chart which was prepared for me by my late assistant house-surgeon, Mr. C. L. Stevens. This chart, Fig. 13, gives the family tree of three generations which have suffered from cleido-cranial-dysostosis. This group of cases came into our hands almost by accident. (Page 472.)

Mrs. W., aged 41, was sent to my clinic at Guy's, complaining of pain of a neuralgic character and inability to wear her dentures. She stated that all her teeth had been extracted four years previously and that she had been wearing dentures from that time until quite recently.

On examination, the alveolar ridges were found to be thick, and the gums hypertrophied. In the upper jaw, on the palatal side of the right incisor region, the tip of a tooth could be felt making its way through the mucous membrane. Figure 14.

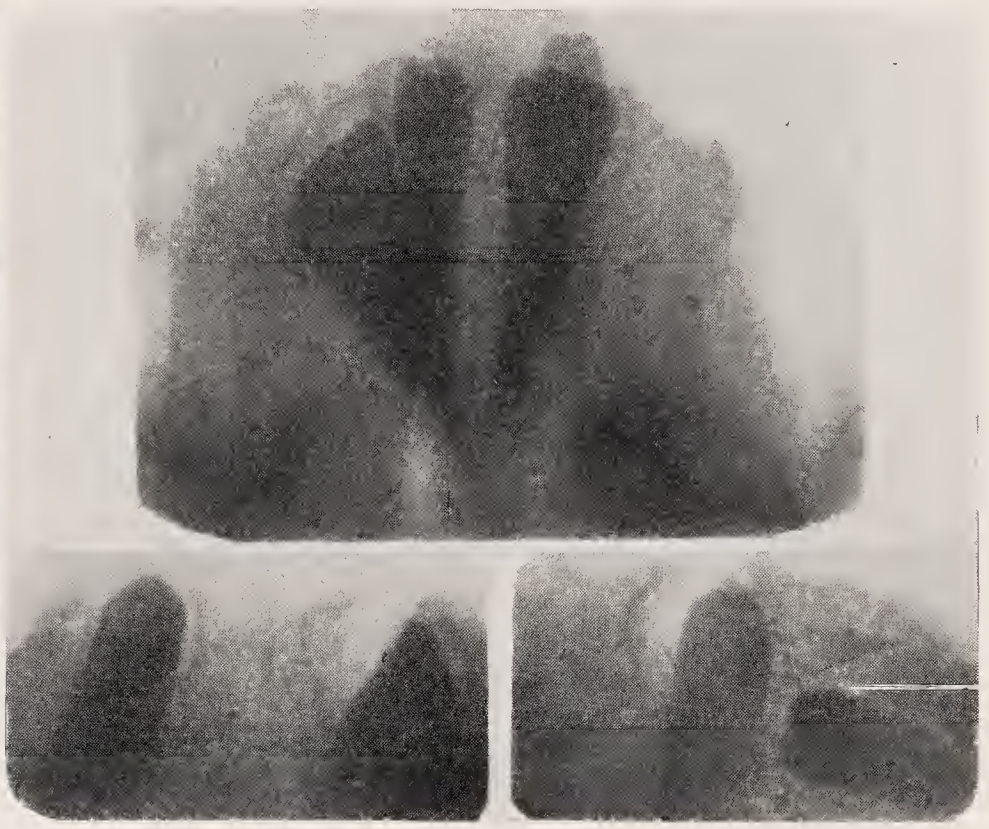
It was decided to have an X-ray examination forthwith. This revealed no less than eight unerupted teeth; in the maxilla there were two central incisors lying palatal to their normal position, and two supernumerary teeth immediately behind them. In the mandible, were four teeth—two canines and two premolars—the canines were in a vertical position, but low down in the jaw; whilst the two premolars, which were on the left side, lay in a horizontal position. The first premolar had its crown pointing towards the ascending ramus and the second premolar was lying immediately below the first with its crown pointing forwards. Fig. 15.

After we had discovered this interesting and unusual condition of her teeth, the patient told us that she had been to another hospital where the doctors informed her that part of one of her "collar

bones " was missing. This led us to inquire more deeply into her case and family history, with the result that this chart was obtained. Mrs. W., herself, has less than a third of the right clavicle present, but the left one appears to be normally developed.

When the buried teeth were extracted at an operation a few days later, a thick fibrous capsule was found surrounding the crown of each tooth.

↓ Tip of supernumerary incisor.



↑ Root of first premolar.

Fig. 14. Fig. 15. Second premolar. ↑

Fig. 14 (Mrs. W.). Models showing the tip of a supernumerary incisor attempting to erupt.

Fig. 15 (Mrs. W.) shows the radiograms of the jaws with the unerupted teeth.

The chart was drawn up from data supplied to us by Mrs. W. There may be some inaccuracies, for we were able to see only nine of those found on the list ; but, as far as we were able to check the cases, her information proved to be correct. Her father, like herself, was reported to have had most of the right clavicle absent, and this was associated with dental deficiency. Mrs. W.'s paternal grandfather, according to her statement, was similarly affected. She has had five brothers and four sisters, of whom one brother and two sisters had normal clavicles. The other seven members of the family have clavicular deficiency, and in each case this defect has been accompanied by dental irregularities, whereas two out of three, in whom the clavicles were complete, gave no history of dental irregularities. A nephew and a niece, in whom portions of the clavicles were missing, each show signs of dental deficiency.

Mrs. W.'s second brother is five years younger than she is. Part of one clavicle is missing. He had all his erupted teeth extracted in 1923, but in 1927 two upper central incisors appeared through the gum. He

CHART SHOWING FAMILY

ASSOCIATED WITH DEFICIENCY

Mrs. W.'s Father:

WITH A HISTORY

B = Brothers. S = Sisters.

B.1.	B.2.	B.3.	B.4.	B.5.
Greater part of right clavicle absent. History of dental irregularity.	Five years younger than Mrs. W. Part of one clavicle absent. All his erupted teeth were extracted about the same time as Mrs. W.'s Four years later two upper central incisors erupted.	Part of one clavicle absent. Dental irregularity.	Part of one clavicle absent. Dental irregularity.	Both clavicles present and complete, but there was some dental irregularity.

BOY.	GIRL.
Clavicles normal. No dental deficiency.	Aged 13 in 1928. Portion of one clavicle missing. At the age of 7, all her deciduous teeth had been extracted, and so far none of the permanent teeth has erupted.

MALE. 2ND MODELS.	MALE.	FEMALE. 3RD MODELS.	FEMALE.	FEMALE.
A. W. Aged 20. On Dec. 28, 1928. ¾ of both clavicles absent. Dental irregularity. See X-rays and Models.	B. W. Aged 18. May 15, 1928. Part of right clavicle absent. Said to have no dental irregularity. Patient not inspected.	M. W. Aged 17. Oct. 1, 1928. Part of right clavicle absent. Permanent teeth not yet erupted. See X-rays and Models.	V. W. Aged 15. Feb. 13, 1928. One of twins. Part of right clavicle absent. Permanent teeth not yet erupted. This patient is a cripple. The other twin died early.	G. W. Aged 14. June 11, 1928. Clavicles present No dental deficiency.

has two children—a boy and a girl. The boy is said to have normal clavicles and no dental deficiency; whereas the girl, aged 13, has part of one clavicle missing. All of her deciduous teeth were extracted when she was seven, and so far none of her permanent teeth have erupted.

Mrs. W. has had a family of thirteen children, of whom three died quite young. Of the remaining ten, four have both clavicles present, and in these children there has been no marked delay in tooth eruption. Whereas, in five of the other six, where some portion of one, or both,

HISTORY OF DENTAL IRREGULARITY

OF ONE OR BOTH CLAVICLES.

greater part of right clavicle absent.

OF DENTAL DEFICIENCY.

1st MODELS.

Mrs. W.
Aged 41. Jan., 1928.
Right clavicle ⅔ missing. All erupted teeth were extracted in 1924 and dentures were fitted. In December, 1927, gums became too painful for the dentures to be worn. Gums found to be hypertrophied and alveolar borders thickened. The cutting edge of a supernumerary right upper incisor could be seen. X-rays demonstrated both central incisors buried in the maxilla with supernumeraries adjacent. In mandible the X-rays showed 2 unerupted canines and 2 premolars.

S.1.
Most of right clavical absent. Dental irregularity.

Boy.
Parts of both clavicles absent. Dental irregularity.

S.2.
Greater part of both clavicles absent. Dental irregularity.

S.3.
Clavicles normal. No history of dental irregularity.

S.4.
Clavicles normal. No history of dental irregularity.

MALE.

Died age of of 2 years.

L. W.
Aged 11.
Aug. 25, 1928.
Clavicles present. No dental deficiency.

FEMALE.
4th MODELS.

Gertie W.
Aged 9.
July 9, 1928.
Greater part of both clavicles absent. Dental irregularity.

See X rays and Models.

MALE.
5th MODELS.

R. W.
Aged 7.
April 13, 1928.
One of twins.
Part of both clavicles absent.
See X-rays and Models.

(The other twin died at 5 months.)

FEMALE.

I. W.
Aged 5.
Jan. 2, 1928.
Clavicles present. No dental deficiency.

FEMALE.

J. W.
Aged 4.
May 21, 1928.
Clavicles present. No dental deficiency.

clavicles is missing, delay in the eruption of the teeth has been observed. I will now deal with each of the members of her family.

The eldest son ("A.W.," aged 20) has the middle portions of both clavicles missing. The fontanelles were closed when he was examined at the age of 7. The only teeth of the permanent series erupted so far, are the first and second molars, both lower second premolars and the right lower first premolar. His deciduous incisors and canines are still *in situ* together with five of his deciduous molars, though two of these are badly broken down. (Fig. 16.)

The chart reads therefore :—

76EDCBA	ABCDE67
7654CBA	ABCD567

The X-ray examination showed (Fig. 17) that the following teeth are present though unerupted.

8 54321	12345 8
8 321	1234 8

and three supernumerary teeth lie buried with the permanent teeth in the following regions :—

8 1	1

Fig. 18. The second son ("B.W.", aged 18) is said to have part of the right clavicle missing and no dental irregularity; but as I have not had an opportunity of seeing him, I cannot confirm that statement.

The eldest daughter ("M.W.", aged 17) has, like her mother, a portion of her right clavicle missing. The anterior fontanelle is not completely closed. The palate is narrow and arched. So far, the only members of the permanent series of teeth that have erupted are the four first molars, two lower central incisors, the right lower first premolar and the left lower second molar :—

6 4	6
6 1	1 67

The following unerupted teeth are detected by means of the X-ray films (Fig. 19) :—

54321	12345
5 32	2345

also, two supernumerary upper incisors can be seen in the radiogram, and these closely resemble those which were found in her mother (Fig. 20).

The second daughter ("V.W.", aged 15) is one of twins. The other twin died early. This child has part of the right clavicle missing. The forehead is large and bossed and the anterior fontanelle is still open. There are signs of rickets and bending of ribs. The only teeth of the permanent series that have erupted are these :—

76 4	4 67
76 1	12 4 67

The rest of the teeth have developed, but lie unerupted, and there are six supplemental incisors in relation with the following permanent teeth (Fig. 21) :—

21	12
2	2

The fourth daughter ("G.W.", aged 9) has the greater part of both her clavicles absent. The fontanelles are closed, no cranial bossing. All of the deciduous teeth are still in position and the first molars have not yet erupted (Fig. 22). The palate is arched and narrow. In addition to the ordinary members of the permanent series which lie buried in the jaws, the following supernumerary teeth can be seen in the radiograms :—

21	2
3	3

The youngest child ("R.W.") with deficient clavicles, is aged 7. Both clavicles are missing except for small fragments at the sternal ends. The deciduous teeth are all in position in the mouth, but the left upper central and lateral incisors are geminated.

Fig. 16.

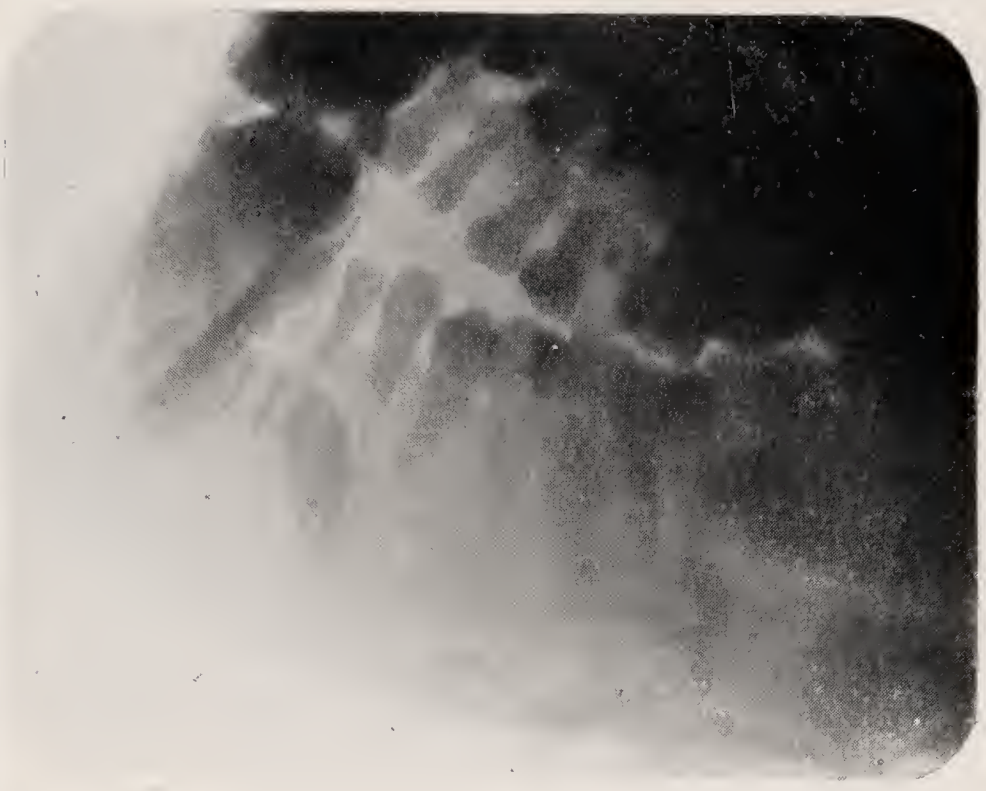


Fig 17.

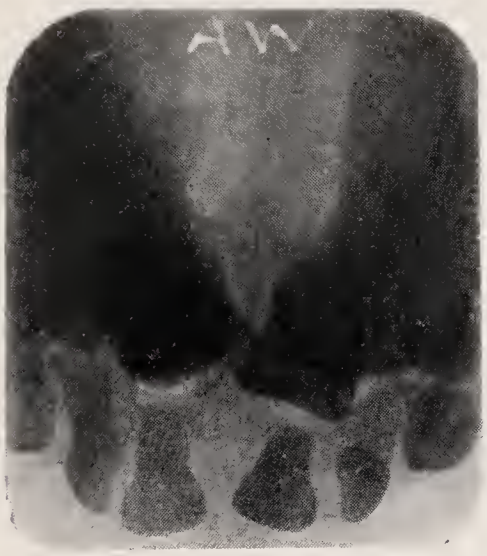


Fig. 18.

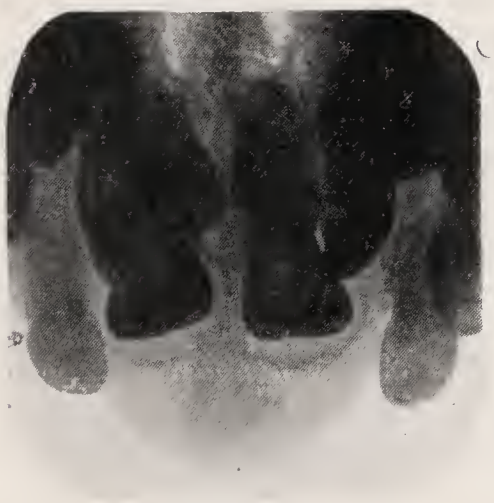


Fig. 20.

Fig. 19.

Fig. 16. Models of the mouth of A. W., aged 20, whose incisors, canines and five of the premolars remain unerupted.

Fig. 17 (A.W.) Radiogram of the right side of the jaws showing the unerupted and displaced teeth.

Fig. 18 (A.W.) shows unerupted permanent incisors and canines with two supernumerary teeth lying close to the central incisors as in the case of Mrs. W.

Fig. 19 (M.W., aged 17). Right side of the jaws showing that only one of the premolars has erupted.

Fig. 20 (M.W.). Upper incisor region showing two supernumerary incisors as in her mother and brother.

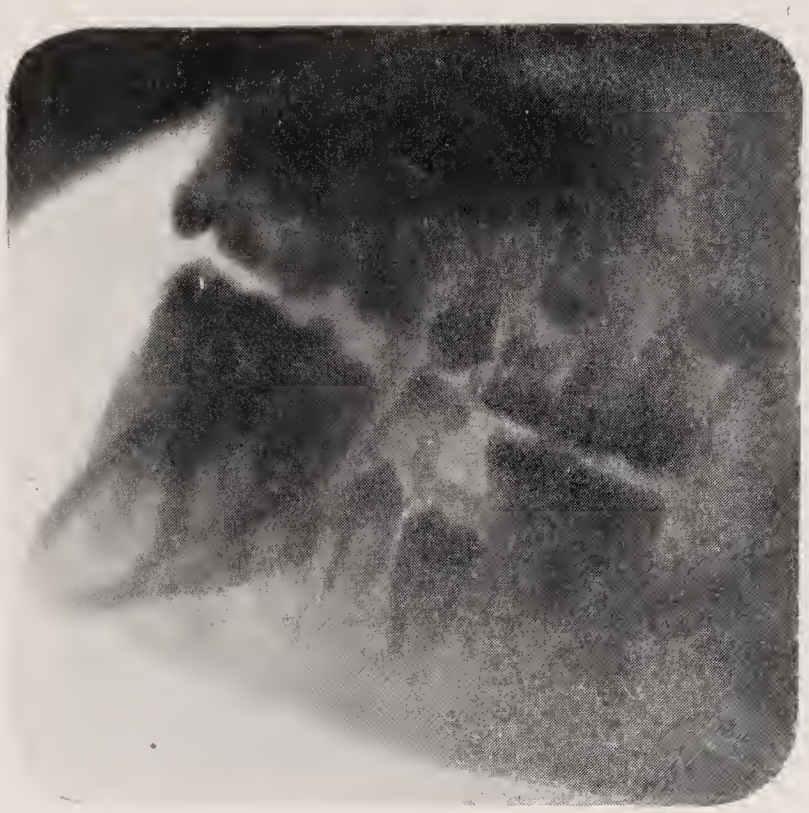


Fig. 21.

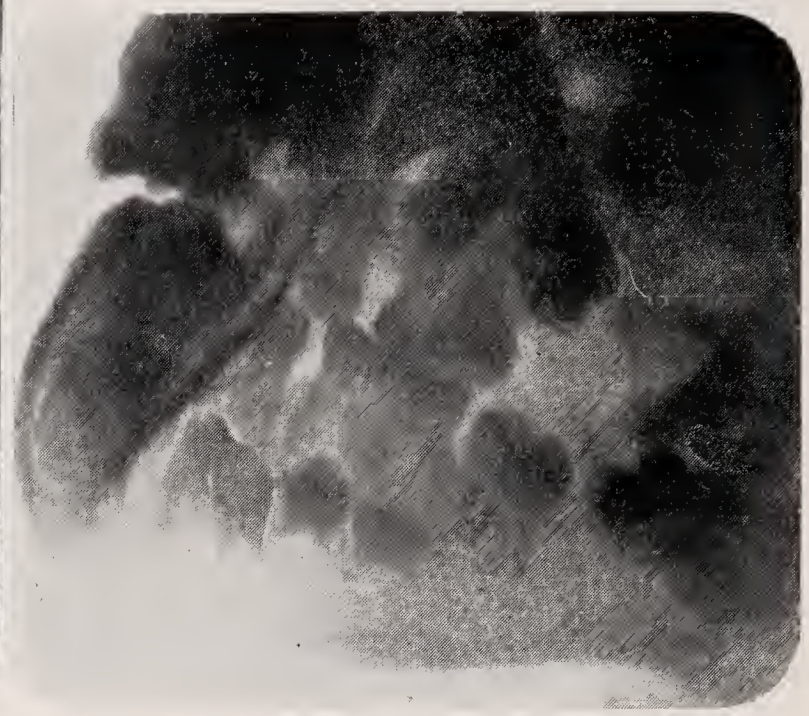


Fig. 22.

Fig. 21 (V.W., aged 15). Radiogram of the right side of the jaws.
Fig. 22 (G.W., aged 9). Radiogram of the right side of the jaws.

The radiograms of this case show the first permanent molars situated deep in the jaws, though the normal time for their eruption has passed.

In searching the literature describing cases of hereditary cleido-cranial-dysostosis, I find that several members of the family that I have just referred to, were seen by Dr. George Carpenter in 1899, and others of the family by Dr. Frederick Langmead, who published an account of the general conditions in the cases that he saw in the *Proceedings of the Royal Society of Medicine* in 1916. Some authorities have stated that this complaint does not extend through more than two generations, but in this series, four generations have been involved.

It was two years ago that I came across the first patient (C.E.S.) (Figs. 12, 13) suffering from cleido-cranial-dysostosis. He was a man aged 46, who had deficiency of both clavicles ; only one and a half inches were present at each sternal end. In the upper jaw the central incisors lay deeply buried and unerupted, and in the mandible the lateral incisors and the canines were similarly situated. In spite of the presence of teeth the jaw was very shallow. There was a symmetrical increase in the width of the skull, and the bones of the vault were thin. Also, there was a deficiency in the frontal bone at the metopic suture. The anterior fontanelle was incompletely closed.

Recently, I have seen two more cases of this complaint and have obtained histories of others. In each instance there has been considerable delay in the eruption of the permanent teeth.

From what I have shown you, it would appear that eruption of all the teeth is delayed in hereditary cleido-cranial-dysostosis, but it affects chiefly the teeth in the front of the mouth, which have deciduous predecessors. The presence of supplemental teeth in many of Mrs.

W.'s family is doubtless hereditary, but, I consider these arise from quite independent causes. It would be unwise to draw hasty conclusions as to the causation of eruption of the teeth from the series of cases that I have brought forward this evening, but I think most of them tend to strengthen the opinion that the growth of bone has a very important bearing upon this question and there is little doubt that in cleido-cranial-dysostosis there is interference with the calcium metabolism. It is probable that this process of eruption is due to several concomitant forces in which the growth of the jaws, the behaviour of the epithelial tissues surrounding the teeth, and possibly even, the elongation of the roots of the teeth, all play a part. It seems to me that bone growth is the primary factor in normal eruption, and that the epithelium surrounding the tooth controls its direction, and, when the tooth is socketed, limits the extent of its eruption to the margin of the enamel around the neck of the tooth.

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DISCUSSION.

The PRESIDENT heartily congratulated the Society on having had the opportunity of listening to Mr. Payne's paper in which the cases brought to their attention were full of interest and gave rise to much food for thought. It was very interesting that the record of these cases should appear in the Transactions of the Society so early in the history of the disease. It was obvious, as Mr. Payne had said, that cranio cleido-dysostosis was connected with the calcium metabolism of the body, which, as they knew, was concerned with the eruption of teeth. Had Mr. Payne any explanation for the two cases which he showed of unerupted teeth becoming carious ? Why should those teeth have been so affected if the usual conception of the causation of caries was correct ? He had intended to comment on the presence of supplemental teeth, but Mr. Payne had given the solution of the problem which he (the speaker) was going to suggest ; the presence of the supplemental teeth must have been due to something quite outside the disease.

Mrs. LINDSAY said she had come across such cases. She asked whether Mr. Payne had ascertained if there was any persistence of the thymus gland, because although it was a very early condition, some early want in the development of the embryo, it might account for the infantile condition, the persistence of the temporary teeth. Was not this disease something like the condition of progeria which Sir Arthur Keith had brought to their notice in which the teeth were also deficient. Franke suggested that supernumerary teeth were nearly always

associated with cleft palate, and their presence was, in fact, one of the stages of cleft palate.

Mr. MESSENGER said he had been extremely interested in the paper, particularly with regard to those cases in which the clavicle was missing. He asked whether there was a history of rickets in that group of cases. He desired to bring to the notice of the members the case of a woman of 28 or 29 years of age, whom he had attended and in whom, under X-rays, they had found about 22 unerupted teeth. There were found to be no clavicles. She had given a family history of delayed eruption in two brothers, one of whom was 43 years of age, with the upper temporary incisors present in position, but he had a number of other teeth. He had then lost sight of that case for a number of years, when, four or five years ago, Mr. Pritchard in reading a communication at the Odontological Section of the Royal Society of Medicine, which had been sent to him by Mr. Pickerill of New Zealand, mentioned a case of neuralgia occurring in the upper right side of the jaws and found to be due to two upper premolars which had not erupted. From the description given in the paper he (the speaker) had identified the case as being that which he had seen years before. From this case he gathered that sooner or later teeth made an attempt to erupt and that that attempt was frequently associated with very bad neuralgia. That woman would now be about 54 years of age. At the age of 18 or 19 she had had teeth extracted which must have been the remains of the temporary dentition, with probably the four first permanent molars. At 28 years of age she had lost 2 upper central incisors and during all this time she was wearing full upper and lower dentures. There was a history of rickets.

Mr. BLAABERG asked why, in this case of lack of dentition and retarded eruption, Mr. Payne called these teeth supernumerary teeth ; they might be laterals ; they were placed on the palatal side of the centrals which was the usual malposition of such teeth. In the models which Mr. Payne had shown them, the right supernumerary appeared to be fairly well formed, but the left supernumerary was a little marred at the tip of the tooth ; laterals were frequently a little marred in that way, particularly under these conditions.

Mr. Rt. LINDSAY said they had all listened with great enjoyment to something which was, perhaps, a little off the ordinary line of studies of the Society ; he was rather inclined to doubt whether it would be possible to learn any lessons either with regard to orthodontics or the development of teeth from what they had seen and heard. It would be better to regard Mr. Payne's paper as a very enjoyable excursion into one of the border lines of orthodontic practice. The disease must be accompanied by such an extraordinary aberration, due to some constitutional disturbance, that nothing they found would astonish them ; for example, the fact that there was delayed or non-eruption of teeth, could only be explained on the constitutional ground of a very severe disturbance. In looking at the X-ray photographs, he had been impressed by the fact that there did not seem to be any material deficiency of the alveoli ; the body of the mandible also, was fairly well developed. Therefore the idea that the alveolar bone was purely dependent for its development on the erupting teeth, and was deficient or absent unless the tooth had erupted, seemed to be inconsistent with what was shown with slides. There was also the fact that the crowns of these teeth, so far as the age permitted, were complete in size although certainly some of the roots appeared to be stunted.

In the earlier part of the paper an interesting point had been raised as to dental caries. It was generally believed that true decay could not take place unless there was some connection with the mouth. He recalled a case in which what was supposed to be decay had occurred in an impacted wisdom, but it had been ultimately proved by careful histological examination that it was not true decay. Mr. Payne's paper bore out this generally accepted theory. He (the speaker) was inclined to disagree with Mr. Payne's suggestion that the elongation of the root had anything to do with the eruption of teeth ; Mr. Payne was on safer ground when he ascribed the eruptive force to the growth of the bone.

He wished to add his thanks to those of others for what had been a most enjoyable experience, and none the less enjoyable because it did not seem to teach them anything.

Mr. W. A. BULLEID said, arising out of the President's remark as to carious teeth, that, where the lower second pre-molar was absent and the second

temporary molar persisted, one sometimes found the temporary tooth nipped between the first premolar and the first molar, with its occlusal surface quite level with, or even below the level of the then existing gum, with the teeth before and behind right above it at their normal level. In the models which they had been shown the carious teeth might have erupted at their proper time, but, with the rising of the premolar in front and the molar behind them, had got nipped above the level of the broadest diameter of the crown, by the teeth before and behind, as in the case of the temporary molars, these permanent teeth might have been held down and in fact forced down by the rising of the two teeth before and behind, and the posterior one drifting forward a bit. That seemed to him to be the explanation of the position of the teeth and of the fact that they were carious.

Mr. PRITCHARD thought one of the most significant facts arising from the paper was that the delayed eruption of teeth concerned only those that had no temporary predecessors ; in the models they had seen, the milk teeth and usually the first and second permanent molars were in position, whereas the teeth which would normally replace the milk dentition had suffered this delay. Caries in unerupted teeth usually occurred in the milk dentition. The speaker showed the meeting a photograph of a very carious second temporary molar which had undoubtedly at some time been in line erupted, but had been forced down again by subsequent movement of the other teeth.

Mr. STRICKLAND described the case of a male patient of his of 18 years of age, whose teeth were unerupted and whose incisors were extraordinarily small, of the Hutchinson type. Two sisters of this patient had normal dentition except that the teeth of one sister were very small. These three persons were the issue of the marriage of cousins, there being, he believed, a previous marriage of cousins in their ancestral history.

Mr. LEWIN PAYNE, in reply to the questions of the President and others, said that at the outset he had himself been puzzled as to the explanation of the carious condition of unerupted teeth in two of the cases he had shown, but he thought he had discovered the reason. As had been stated in the discussion, unexposed teeth did not become carious. In the first of the two cases—that of the boy of 13—the right first molar had a dilacerated root, in addition to the caries. This dilaceration occurred also on the left side. The boy had had two operations performed on his throat under general anæsthetics at about the period when this dilaceration occurred. At the time when dilaceration occurred probably the tooth was in the process of eruption and its erupted crown exposed on the surface. Was it not possible that a gag was put into the mouth, and by pressure upon the molars had driven them back into their sockets ? Such a theory might explain the presence of caries as well as the dilaceration of the roots. In the second case there was a definite sinus connecting the tooth with the surface of the gum.

Mrs. Lindsay had referred to the persistence of the thymus gland ; he had not seen that question discussed in any of the papers which had been written upon the subject of cleido-cranial-dysostosis. He thought, however, that this disease was in the nature of a deficiency disease, and might very well be described as allied to that condition known as progeria to which Sir Arthur Keith had referred at a meeting of the Society some two or three years ago. The number of persons suffering from this disease who also had cleft palates, was certainly large. The palate of the mother, to whom he had referred in his paper, was deep, and a very definite groove in the upper jaw was shown in the first model.

Mr. Messenger had suggested that these case were due to rickets. Mr. Lewin Payne said there was no history of rickets in his group of cases. Rickets might be associated with this disease and in some of the recorded cases there is evidence of such a combination, but there were certain definite symptoms which distinguished hereditary cleido-cranial-dysostosis from rickets. The character of the skull, the late closing of the fontanelles and other deficiencies might bring the two conditions into close alignment, but the general character of the chest was certainly not that of a rickety patient. Rickets and cleido-cranial-dysostosis might occur simultaneously in the same patient, and that seemed to be so in the case to which Mr. Messenger had referred.

In reply to Mr. Blaaberg, he considered the teeth of the mother to be super-

numerary because they were not of the normal form of lateral incisors. Also, supernumerary teeth of a similar character were to be found in other members of that family whilst the lateral incisors were still present. As to the criticism that the paper was unsuitable to this Society, it seemed to him that the question of eruption of teeth was one of the most important for the British Society of Orthodontics to discuss, but he was sorry that Mr. Lindsay had been unable to learn anything of orthodontic interest from the cases which had been shown. He agreed with Mr. Lindsay that the growth of bone, working in combination with the action of the epithelial cells, was the chief factor in the eruption of teeth, but he still felt that the elongation of the roots did play a secondary part in many cases.

HEREDITY

By J. T. CUNNINGHAM, M.A.Oxon., A.L.S.

THE Author said the aspect of the study of heredity which at present attracted most attention, and had done so for the past 29 years, was that of the study of particular characters. Before that it had been quite obvious on any general survey of plants and animals, and especially the human species, that variations, i.e., differences between individuals, were not always of a small character and did not always form a gradual series, but were often very pronounced and sharply marked. That was very often the case in human subjects and was obviously the case in different breeds of domesticated animals. They were not this evening referring to plants to any great extent. It was also obvious in wild forms that the distinction of species in the majority of cases was not a matter of differences of degree but of the presence or absence of special characters. So that it was obvious before the present period of the study of heredity that there were a great number of cases in which pronounced and conspicuous characters formed the distinction between different races and breeds and also between individuals.

But it was only since 1900 that the systematic attempt to investigate the heredity of such definite characters had been carried on. Those present probably all knew that that originated from the investigations of the Abbé Mendel, which had been published half a century before, attention being re-directed to them in 1900; the development which had arisen or proceeded from that re-discovery had given rise to an enormously important branch of biology; it was with that branch that he proposed to deal tonight.

The method initiated by Mendel was to pay attention to a particular character in one form or variety and its corresponding character in another, closely related, the two characters corresponding in the sense that they affected the same part or organ of the body. The heredity of the two characters was investigated by crossing, or breeding together, individuals of the two forms, males of one with females of the other, and recording statistically the different kinds of offspring produced in each generation derived from the cross.

One of Mendel's chief discoveries had been that in the first generation the offspring of such a cross were all alike with regard to this

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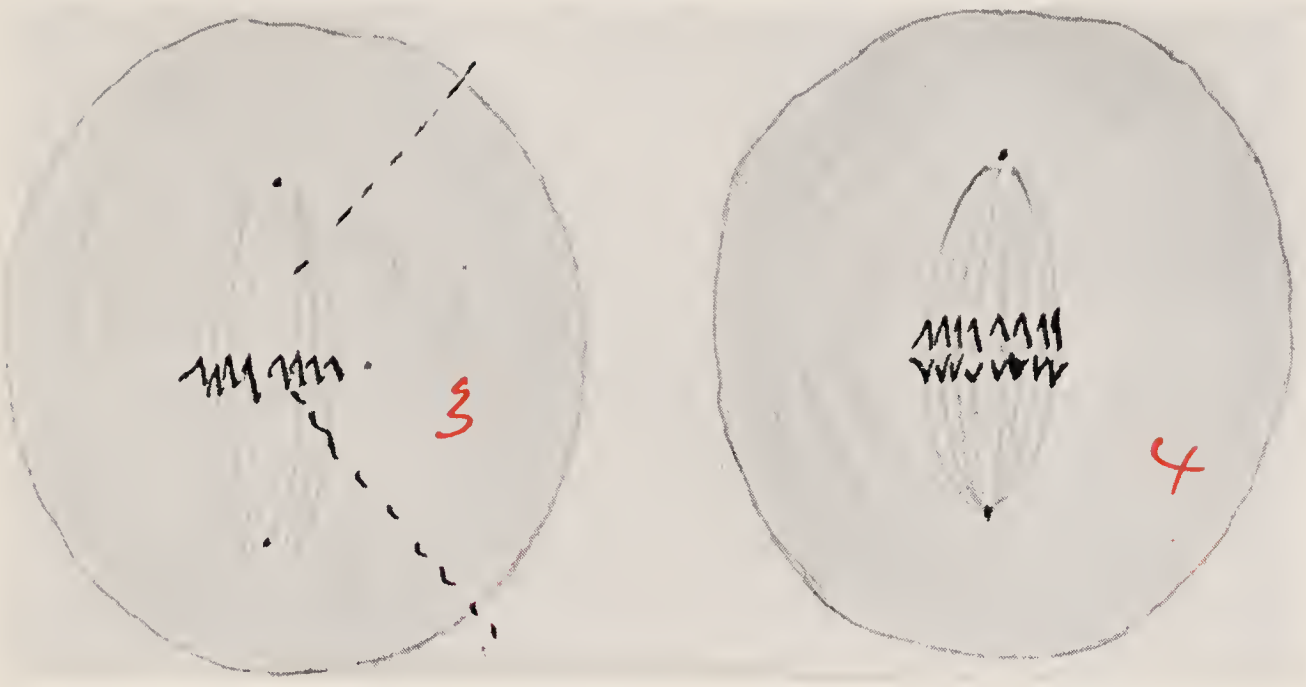
ERRATUM.—We regret that in printing HEREDITY illustrations, the two upper illustration blocks on page one are wrongly placed ; the second block should have been inserted at the top so as to illustrate Fig. 1 Resting, and Fig. 2 Prophase spireme. The top block should be placed under it, illustrating Fig. 3 Metaphase, and Fig. 4 Anaphase. One lead line in Fig. 3 will then point to spindle and the other line will point to eight chromosomes.

MITOSIS

1. Resting Centrosome 2. Prophase Spireme



Spindle

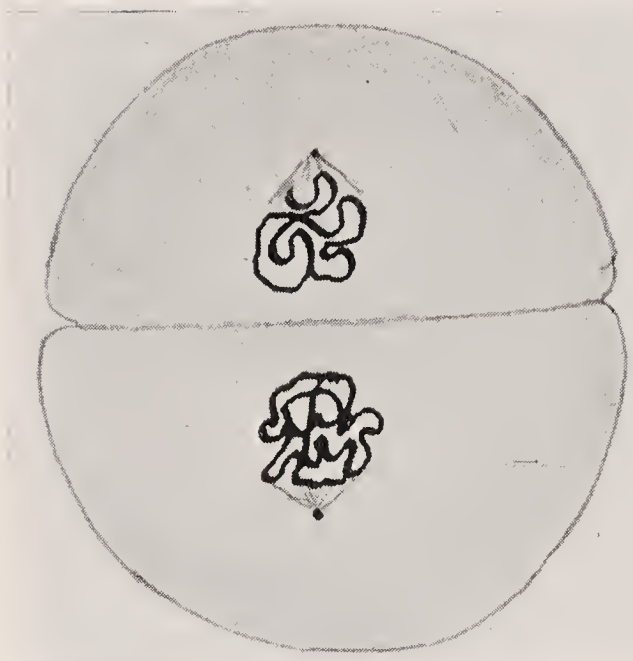
3. Metaphase 4. Anaphase

8. Chromosomes

5. Metaphase seen from Pole 6. Anaphase

MITOSIS (*continued*)

7. Telophase

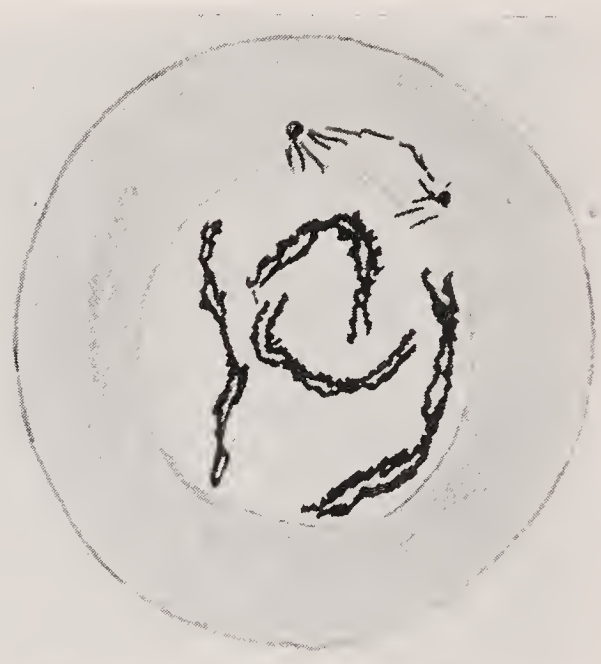


8. Division Complete

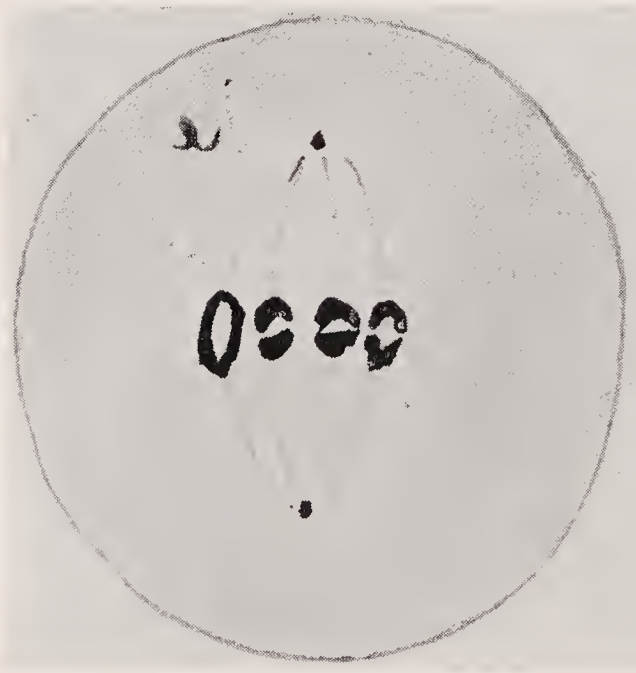
REDUCTION OF MEIOSIS

1. Prophase

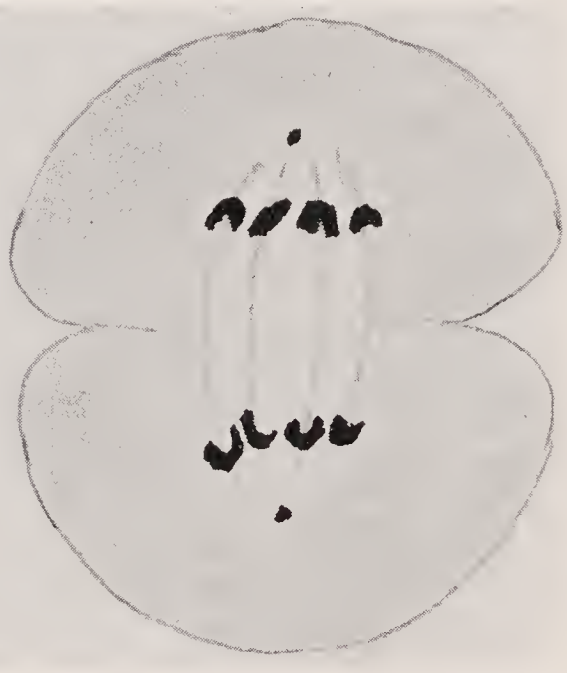
2. Synapsis



3. Metaphase



4 Anaphase



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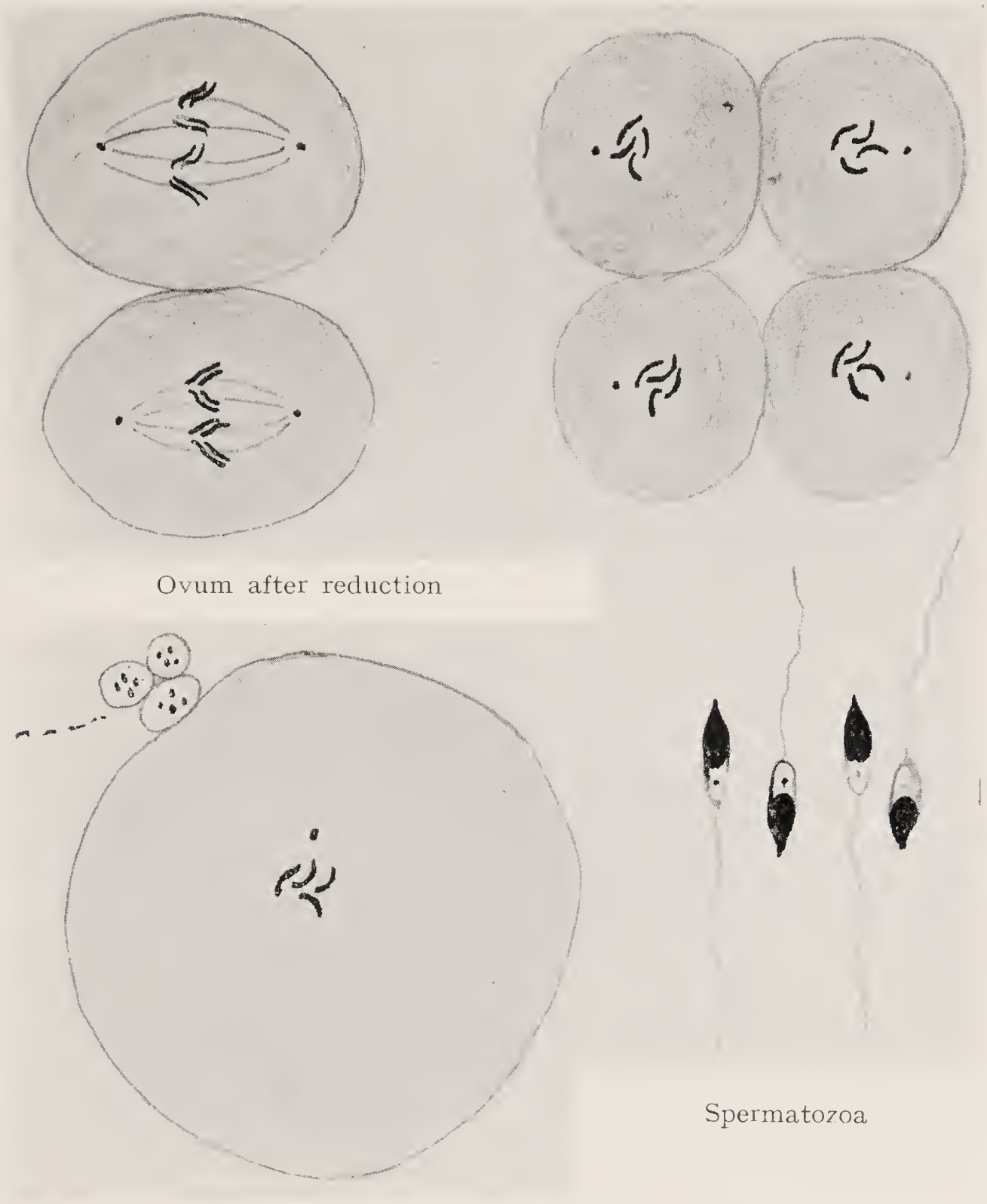
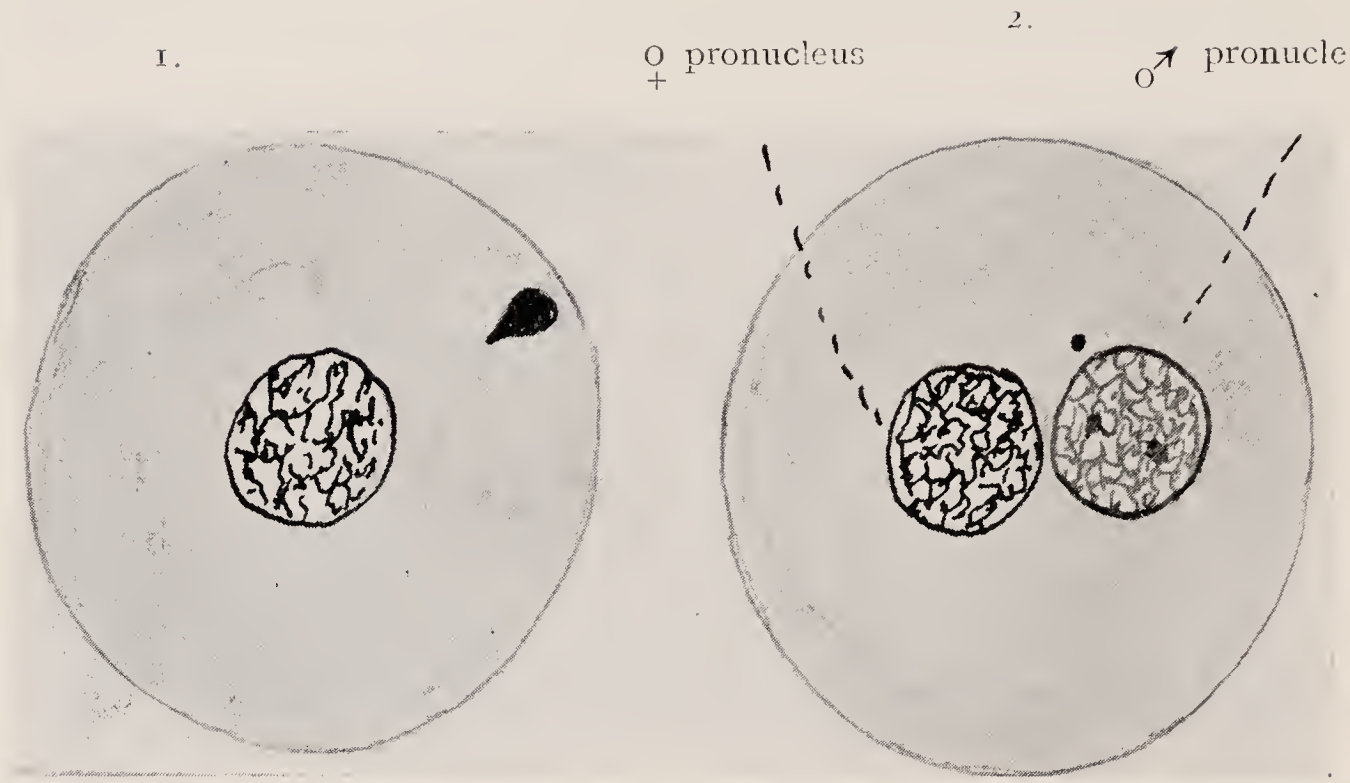
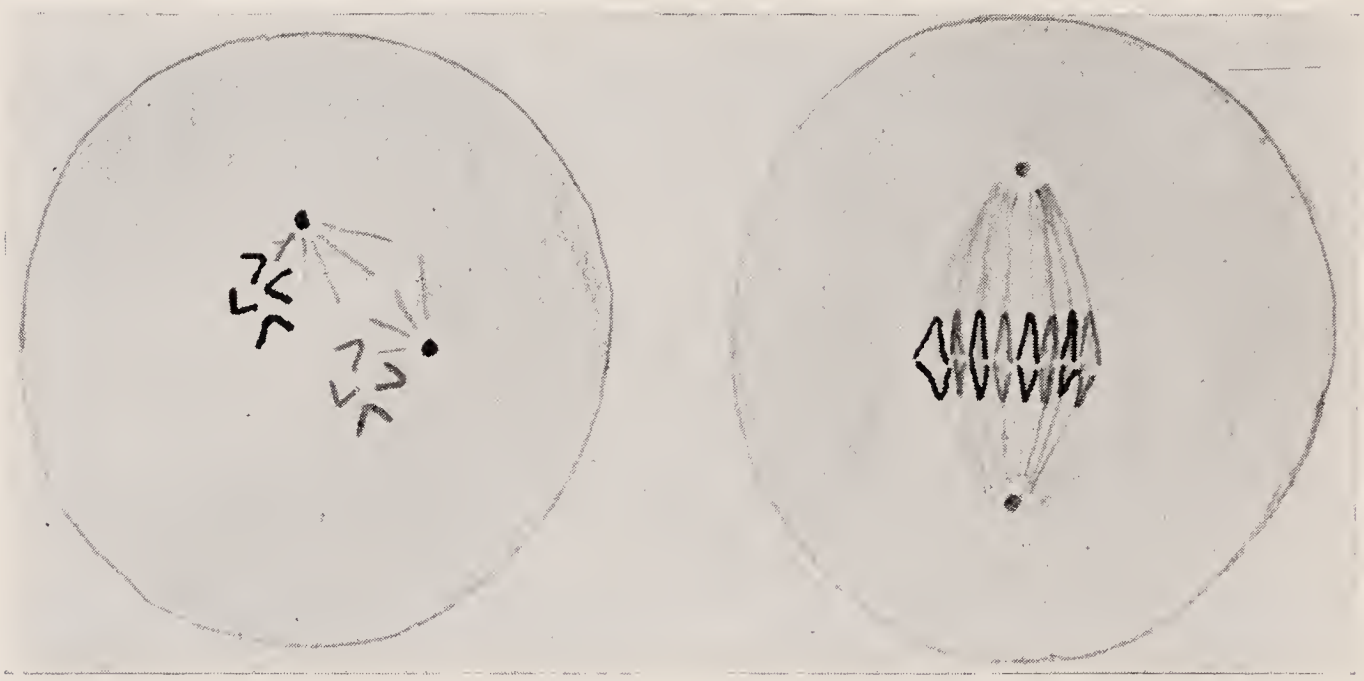


Illustrating Mr. J. T. Cunningham's communication on HEREDITY.

FERTILISATION





3.

4. 1st segmentation spindle

Illustrating Mr. J. T. Cunningham's communication on HEREDITY.

particular character or pair of characters. It had been for some time supposed that it was a general fact as discovered by Mendel—in fact, Mendel had rather emphasised it—that one of the characters concealed the other and appeared exclusively. This was called the dominant character, and all the offspring showed this dominant character. It had since been shown that in many cases that was not so; there were many exceptions, and it was now agreed that the important fact was not the dominance of one character but the fact that the individuals of the first generation were all alike. There was no exception to that, at any rate in typical cases.

The lecturer then showed a slide which illustrated the inheritance of a pair of characters in Mendelian fashion, in fowls having single and rose combs. These two characteristics were not restricted to any two breeds; there were a great many breeds of fowls which had rose combs or single combs. The black-red wild fowl (*Gallus bankiva*) had a single comb, that being the more primitive form; there were other fowls which had neither rose nor single combs. He desired to show them the result of crossing a fowl of a rose comb breed with one of a single comb breed. The result was that all the offspring of the first generation had the rose comb to the exclusion of the single comb. In that case the rose comb was said to be dominant, because it dominated over the single comb and concealed it, while the single comb was said to be recessive. The offspring of this first generation were called F.1. When the individuals of that generation were bred together it was found, on counting a large number of the chicks produced, that there were on the average three rose combs to one single comb. So that the single comb reappeared, and it was found to be as perfect as though the breeds had never been crossed at all. This was called segration in the F.2. generation, where both the original characters reappeared in exactly the form in which they existed in the original parents, who were now the grand-parents.

Mendel had found, and his result had been confirmed by everybody who repeated these experiments, that if these dominants were crossed with one another or with the recessive form, one third of the dominants were pure, that is to say, they produced dominants only. In this particular instance, the characters came out in the proportion of 1 pure rose comb, 2 hybrid, and 1 pure single. The explanation of this which Mendel gave, and which has been confirmed ever since, was that the characters were produced by the reproductive cells, or gametes, that each character was represented by something which was conveniently called a factor in the eggs or sperms. In the F.1 generation of these fowls, each individual was developed from a fertilised egg carrying both factors, the rose comb from one parent, the single comb from the other, but of the eggs produced by each F.1 individual, half the number carried the factor which produced the rose comb, while the other half carried the factor which produced the single comb; that though they were combined in the individual, they were separated in the gametes. The same thing happened with regard to the sperms. The consequence was that when fertilisation took place, half the eggs were rose comb eggs, and half were single comb eggs, or, to make it simpler, he would call them dominant and recessive. A recessive

egg might be fertilised by either a dominant or a recessive sperm, and so the number of eggs fertilised by dominant sperms would be the same as the number fertilised by recessive sperms. Similarly, a dominant egg might be fertilised by a dominant or a recessive sperm.

The conclusion was that when the reproductive cells, gametes, of the F.1 hybrids were formed, the factors for the two characters united, denoted by "A" and "a," for example, separate, so that both in the male and female half the gametes contained "A" and half contained "a." The fertilisations were therefore AA, Aa, aA and aa in equal numbers. If "A" was dominant, this meant three dominants to one recessive in the F.2 generation; the recessives and one-third of the dominants were as pure as the original parents, while the remaining dominants were similar to those of the first generation or F.1. When two pairs of characters were crossed there were sixteen different combinations, and, if two of the characters were dominant, four visibly different forms. The Mendelian principles explained reversion on crossing and the results of crossing were used to discover the unit factors which did not always produce visible characters.

There were some cases of crossing in which dominance did not occur; such was the case of the Andalusian fowl. The colour of that fowl was called blue; it was a kind of blue, but was scarcely such a distinct blue as one obtained in ordinary colours; it really consisted of black particles mixed with white. It had long been known to fanciers that on breeding these fowls together, among the offspring one got only a certain number of blues, there were always a number of "wasters" or "rogues," some of which were pure black and some white, splashed with black. By the aid of Mendelian principles, scientific people were able to score over the practical people very markedly in this case, because they showed that by mating two wasters, one black and the other white with black patches, one obtained offspring which were all blues and nothing else. That had been a great revelation to the practical man. That was so, because in the case of the Andalusian fowl there was no dominance; there were two pure forms: one pure form was black and the other splashed with white; the hybrids had the two characters so mixed that they appeared to be blue, and when bred together, produced the two pure forms and the hybrid again.

Interesting results were seen when two pairs of characters were crossed at the same time, as, for instance, rose or single combs, and white or coloured plumage in fowls. Some of the results of Mendelian breeding were exceedingly surprising and paradoxical, for example, the production of coloured fowls from the mating of two recessive whites, and the production of coloured sweet peas from two white varieties.

There was the question of how these characters were carried. He had spoken of the characters being carried in the gametes, the reproductive cells. At the same time that the investigations of those factors was going on, there had been proceeding quite independently an investigation by means of the microscope of the structure of the nuclei of cells and their sub-divisions. The nucleus in ordinary cell-division was resolved into distinct particles called chromosomes, each of which divided into two, the number remaining constant for each variety of

organism. In the formation of the gametes, the chromosomes became paired, and one member of each pair passed into each daughter cell, so that each gamete contained only half the normal number of chromosomes. In fertilisation the chromosomes of male and female gametes passed into one nucleus. Thus the separation and pairing of the chromosomes corresponded to the separation and union of the characters, the genes or factors being contained in the chromosomes. The ordinary division of the cells was called mitosis, but in the last phase of division before the ripe eggs and ripe sperms were formed, there were two divisions which were different from mitosis and were known as reduction divisions. The offspring did not inherit all its qualities from either parent; each parent, as it were, threw away half its inheritable characters and handed on the other half. It could be illustrated by supposing a man and woman to meet with two packs of 52 cards each, each throwing away 26 cards, and putting the remaining half-packs together to make one complete pack. But the 52 cards are in 26 pairs, and the two of each pair separate when the gametes are formed, and form new pairs in fertilisation with the corresponding cards from the other pack. Suppose one pair in each parent are one blue and one black, then the new pair after fertilisation will be either two blue, or two black, or blue and black, in the proportion 1 : 1 : 2.

Very precise investigations had been made by Professor Morgan of Columbia College, New York, and his colleagues, as to a little fly that fed on bananas. This fly was of a character particularly favourable to these experiments; it had only four pairs of chromosomes. Characters were not always inherited independently, by what was called free assortment, but often, as in the case of this fly, Drosophila, and other cases, were linked together in groups which were inherited together as one character. This was attributed to the fact that the genes of the linked characters were all in one chromosome and passed into the same gamete, except when crossing over occurred. It was found that this linkage was sometimes broken, and it was claimed that by studying the cases in which the linkage was broken, which were exceptional cases, with the normal cases, it was possible to tell the position in the chromosome in which the characters were situated. The particular points in the chromosome which carried the characters were called the genes. If there were a number of cases in which the two coupled characters separated, it was concluded that the two genes were far apart, because the reason of the breaking of the linkage was the crossing over. This was merely theory, but it was borne out by the observed facts. It was even said that a map might be drawn showing where the characters were situated in the chromosome.

Extraordinary facts had been observed concerning the inheritance of sex. It had been noticed in the early days of Mendelism that sex inheritance corresponded to, or appeared to resemble the Mendelian inheritance in certain cases. One of the extraordinary things about sex was that in every union of parents, the male and female were combined, while in every production of offspring they were separated again. Sexual intermediates did sometimes occur, but persons of abnormal sex were extremely rare in comparison with the normal.

When a hybrid, an impure dominant, was crossed with a pure recessive, it was found that the offspring were dominant or recessive in equal numbers. It had been suggested that sex was a Mendelian character, one of the sexes being hybrid and the other pure. It was not necessary to go into the detail of that theory, because it had been rather superseded by a simpler statement of what took place in the chromosomes. The investigation of sex by characters and the investigation of the chromosome by the microscope had given comparative results, one confirming the other.

There was reason to believe that one pair of chromosomes determined the sex of the individual. In mammalian animals the two sex-chromosomes in the male were different, X and Y; in the female they were similar XX. Therefore of the sperms, half contained an X and half a Y: while all the eggs contained an X. Therefore after fertilisation half the eggs contained XY and became male, half XX and became female.

The inheritance of sex was curiously paralleled by what was called sex-linked inheritance, of which one of the well known cases was red-blindness in human beings. Red-blindness occurred in about 5 per cent. of males but was very rare in females. A colour-blind father never produced a colour-blind son; a male could not inherit colour-blindness from his father. The colour-blind father handed on that character to his daughters; they did not show it, being merely carriers. If a woman who was carrying colour-blindness married a normal man, half her sons were colour-blind, a character which they inherited from their maternal grandfather. Female colour-blindness only arose when a colour-blind father married a woman who was carrying colour-blindness, in which case half the daughters would be colour-blind.

There are a great many other characters in the human species which were inherited in Mendelian fashion, most of them being abnormalities. There was more variation in any human community than in most of the wild species, and especially more among human beings than in a cultivated species, because a pure bred fowl or a cultivated plant, for example, were bred so that all the individuals should have the same character. Cultivated plants and animals were pure as to most of their characters, whereas human beings had a great many characters in regard to which they were crossed; that is to say, human beings were carrying a lot of recessive characters besides those which they showed. One geneticist had described man as a "mongrel," and that was very true. It was impossible to experiment on human beings. There was a great deal of talk on what was called eugenics, but it had not come to much yet in practical execution. Heredity in man could only be studied by means of pedigrees which presented great difficulties. Some results had, however, been obtained. It had been found that blue eyes were recessive to brown or dark eyes.

On looking up the question of teeth, he had found that heredity information was rather unsatisfactory. He had, however, come across one or two examples in which pedigrees were given, especially in Sir Frank Colyer's *Dental Surgery*. That was a standard work recognised in dentistry and his account was one of the best he had come across. He had given some cases of heredity in abnormalities of the teeth.

Hereditary hypoplasia of the teeth was a rare condition; when only the enamel was deficient the teeth might be of a dark brown colour. A case had been recorded of this kind in which 42 individuals were examined, extending over four generations, and 23 of these persons had defective enamel. In severe forms there was deficiency of dentine as well as enamel. An excellent account of a family showing this type was recorded by Mr. J. G. Turner during five generations of 50 individuals of which 21 were affected. The abnormality was transmitted through abnormals; it was therefore dominant. When a child was born which had not got the abnormality, the subsequent generation showed that it did not transmit the abnormality at all. There were some other cases which were recessive, but they were rather extreme cases and were not often met with.

There had been one case of two brothers recorded by J. H. Gibbs, in which the teeth were entirely absent. That was, he presumed, very rare. It was found that that was a recessive character which was sex-linked like colour-blindness. There were many other cases of abnormalities described, in which no pedigrees were given. There was one case of entire absence of teeth with marked deficiency of hair. Hare-lip and cleft palate were associated to some extent with the teeth, generally involving abnormalities of the teeth. They were probably better known than dental abnormalities proper. They were known to be dominant. They were cases in which the development of the maxillary region of the head and the palatal region was arrested instead of going on to its complete closure. He had come across rather a curious mis-statement in a book, which was not very old, in which hare-lip in the human species had been compared with the cleft lip of the hare. Those two things had nothing to do with one another. The hare-lip in man was never really a central splitting; it was on one side or the other; it was really a retention of the cleft between the lateral maxillary process and the central maxillary process which normally united. In the hare the splitting of the lip was a normal and quite independent character, evolved for the function of allowing the lips to be drawn back to expose the incisor teeth.

There was a very great field for further investigation of the heredity of abnormalities in teeth. If those dentists who were sufficiently interested in the matter and had sufficient time and opportunity would try to collect the pedigrees of the patients who showed interesting abnormalities, they would be making a most valuable contribution to the study of human heredity and also doing valuable service to their own profession.

Discussion.

Dr. Cockayne thanked the Society for affording him this opportunity of taking part in the discussion. He had brought a few pedigrees of dental abnormalities. Mr. Cunningham had said that the "Y" chromosome carried no characters; in most cases that was so, but he believed there were two fish, a beetle and a plant, in which the "Y" chromosome carried a group of characters. In that case, whether the characters were dominant or recessive, they went to all the males, none of the females having these characters. (The speaker illustrated his remarks with slides.) In a case of webbing between two of the toes

in a human being, this character was found in all the males who were descended from males of that family, but in none of the females or in males descended from females of that family. This had been recorded by Schofield, in whose family this abnormality had appeared. The absence or baulking of the upper lateral incisors was one of the commonest dental abnormalities. Apparently it was a dominant. Unfortunately, the investigator, who many years before had published the pedigree of a family affected in this way had not appreciated the importance of recording the unaffected members of the family. One could not, of course, expect to get perfect examples of Mendelian inheritance in small human families; the proportion of the progeny affected and unaffected did not always work out in accordance with Mendelian theory in human families, owing to their being so small. The speaker asked whether anyone present had come across familial or hereditary cases of incisors erupted at birth not accompanied by thickening of the nails. The speaker showed a number of slides, one of which showed dog-faced boys ; they were covered with silky hair all over the face and body, though the hands and feet nearly always escaped. It was a dominant character, and was interesting in that the persons affected, as a rule, had only four teeth. One would suppose that with an excess of hair they would probably have an excess of teeth. The speaker showed a picture of one of these dog-faced boys which he had come across in Aberdeenshire; it dated from the sixteenth century. There was at that time in Europe, a famous family who were affected in this way ; several quite well known artists had painted the father and his two daughters.

Mr. C. SCHELLING said that some years ago, he had been called upon by the late Dr. R. Muir, of New Cross, to extract two lower incisors from a newly born baby, as the mother found it impossible to nurse this, her first child, owing to the lacerations of her nipple caused by his vigorous sucking. The case was reported to the Odontological Society.

Mr. J. G. CUNNINGHAM, in reply, said there were cases of transmission of characters by the "Y" chromosome, though the matter had not yet been thoroughly investigated. He had desired to compare sex linked characters with what were called secondary sexual characters, but had been prevented by lack of time. Dr. Cockayne had shown them some most interesting pedigrees. The secondary sexual characters were obviously carried in the autosomes and not in the chromosomes; their development, apart from their heredity, was dependent upon the internal secretions or hormones from the generative organs. It had always been a point of great interest to him, that all this Mendelism, important as it was, did not throw any light upon development by the influence of hormones. The general theory, as advocated by Dr. Morgan of New York, and more or less imposed upon biology by him, was that all evolution was due to mutations, where simple abnormalities arose without any reason, especially without any reason from external conditions, and giving rise to all the phenomena of adaptation merely by natural selection. That was a conclusion with regard to heredity which he, the speaker, absolutely repudiated; the more he studied the matter the more sure he was that it was erroneous. These abnormalities were of great importance, and they corresponded to many things, but they did not correspond in any way, or offer any explanation for adaptation, and especially the development under the action of hormones. There had never been a mutation yet, as far as he knew, which resembled in any way a secondary sexual character and the influence upon it of, or its dependence upon the influence of the sexual organs.

The CHAIRMAN said they had had a most interesting evening and thanked Mr. Cunningham most heartily for having given them his valuable time.

DEMONSTRATION MEETING, MAY 6TH, 1929.

Mr. HAROLD CHAPMAN showed :—

(1) The use of a loop in the centre of the lingual bow to obtain lateral expansion of the dental arches.

As suggested by Dr. Le Roy Johnson, greater resiliency is obtained if the loop is made of wire one gauge thinner than the rest of the bow.

He also showed how it might be possible to test the direction of movemen that would be obtained after opening the loop and making counter-bends, by means of Mr. H. G. Watkin's apparatus, shown at a previous meeting of the Society.

(2) A simple locking device for lingual arches, consisting of a short length of wire, about 1 mm., soldered on the band 1 to 2 mm. in front of the vertical tube and directed towards the mid-line of the body. The lock wire is placed gingivally to this short spur instead of to the vertical tube.

(3) How increased anchorage may be obtained by suitable design of bows : (*a*) against distal movement of anchor teeth by means of a spur medial to each canine or first premolar or deciduous molar ; (*b*) against distal movement of anchor teeth by means of a distal extension of the lingual arch to engage the distal surface of the most distal tooth. By other modifications anchorage against all movements of the anchor teeth may be increased.

(4) A simple method of avoiding teeth in the line of the bow by soldering to the bow, constructed as if the misplaced tooth were not present, a loop to go round such a tooth, and then cutting out with a saw the piece of the bow between the points where the loop is soldered.

(5) That, in conjunction with a half-round vertical tube on one side for the attachment of the lingual bow, a round vertical tube or round horizontal tube may be used on the other side ; this facilitates the fitting and adjustment of the bow. Translational movement of the anchor tooth may still be obtained by suitable arrangement of the bow or by soldering a vertical spur or spurs to it, which will prevent rotation of the anchor tooth.

(6) That the resultant of forces is more favourable for the tooth movement usually necessary (labial) if auxiliary springs are soldered at or near the centre of the lingual bow instead of on the sides.

Mr. H. R. EVANS demonstrated some treated cases of post-normal occlusion.

Mr. NORMAN GRAY demonstrated precious metal molar bands :—

The materials I have found most satisfactory in this technique are Thos. J. Dee's Ortho D Band Material, gauge 18 ×.006. At the first appointment, separating wires are inserted between the contact points of the adjacent teeth. The next day these are removed and the circumference at the gingival margin of the crown is obtained by means of a copper strip, such as is used in crown and bridge work. The copper strip is carefully straightened out, and a piece of band material 1 mm. larger is cut off. The band has one edge bevelled to the extent of 1 mm., and this is carefully overlapped with the other edge to make a ring. If this overlapped joint is held with a pair of pliers, heated to redness and then quenched in water, it will be found that the two edges remain in contact. Flux the joint and solder with a spot of 18 ct. gold wire solder.

The band is now approximately contoured to the shape of the tooth and pressed over the crown, with the joint lingually. With the aid of orangewood sticks or wooden tongue depressors, the patient is asked to bite the band firmly into place—a simple process if removed and annealed once or twice. The patient will exert pressure more satisfactorialy than the dentist can.

The next step is to contour the band with crown-contouring pliers exactly as in making a shell crown. The band is replaced on the tooth and the top edge burnished hard against the crown of the tooth with

the aid of a band-burnisher. The band should now be a tight fit to the tooth, so that it needs to be removed with the band-removing pliers. Scratch marks are now put upon the band to mark the position of the Dee tubes, buccal tubes or whatever form of attachment is required for the appliance. These are soldered in position.

With the bands in the mouth a compound impression is taken. After removing the impression remove the bands from the teeth and carefully place in the impression. This gives a plaster model with the bands *in situ* ready for making the appliance.

Mr. O. HENRY showed some corrected cases, with appliances (the Crozat). Six disto-occlusion cases were shown; some unilateral, some bilateral; some were division 1, some division 2, and one case, 18 years old, had also an impacted canine.

Mr. H. C. HIGHTON gave a demonstration of the construction of molar bands, lingual and buccal arches, with their various attachments.

Miss K. C. SMYTH gave the following demonstration on types of orthodontic appliances, with details of construction :—

Case I.—Age 8 yrs. 10 mths. Diagnosis: Inferior post-normal occlusion, with labial inclination of upper incisors, rotation of upper permanent molars, and lingual displacement of lower incisor. Treatment: (1) Rotation of upper molars; (2) Intermaxillary traction, with labial movement of lower incisor.

Case II.—Age 8 yrs. 7 mths. Diagnosis: Angle Class III (incipient). Treatment: Forward movement of upper incisors. (Slide showing profile exhibited.)

Case III.—Age 9 yrs. Diagnosis: Inferior post-normal occlusion, complicated by medial displacement of lower permanent molar and distal displacement of deciduous canine, following loss of 1st deciduous molar. Also, lingual displacement of lower incisors, varying in degree. Treatment: Opening of space for lower first premolar by distal displacement of permanent molar, and labial displacement of deciduous canine and permanent incisors. Later, intermaxillary traction.

Case IV.—Age 10 yrs. 11mths. Diagnosis: Subnormality of maxillary and mandibular bases, causing crowding especially of the upper arch, with lingual inclination of central incisors and labial displacement of laterals and canines. Treatment: (1) Extraction of 1st upper premolars; (2) Retraction of canines.

Reference models, appliances, and diagrams of each case were shown, and the stages of construction of the appliances were demonstrated.

A CASE OF "CLOSE BITE" NOT ASSOCIATED WITH EITHER POST-NORMAL OCCLUSION OR MOUTH-BREATHING.

By Barrington Eady, L.D.S.R.C.S.Eng.

In consequence of its nature as a short communication, the subject matter of the case, which I offer for your merciful criticism, has been made as comprehensive as possible.

Its principal interest lies in its rarity, and I believe it has no precedent in the transactions of this Society.

The treatment of the malocclusion concerned was completed before the publication in 1927 of Sim Wallace's monumental Cartwright prize essay of 1920-1925; and I wonder in retrospect, having read the essay, whether there was much work that I did which might not equally well have been done had the correction of the deformity been left to natural development.

My wondering originated in these following extracts from Sim Wallace's "Variations in the Form of the Jaws."

On page 57, he says: "Although the growth of the jaws is a continuous process, at certain stages there are at least local, if not general, exacerbations of growth. One of these stages may here be referred to. The eruption of the first permanent molar marks a stage when growth in the neighbourhood of this tooth is particularly active, and with the upgrowth of this tooth there are changes in the alveolar border, not only of this particular tooth, *but of all the teeth in front of it*. The teeth all rise" (with the alveolar process) "to some extent. The eruption of each tooth has a certain influence on the development of the jaws."

On page 119, again referring to this upgrowth of teeth with the alveolar process, he says: "Similar changes take place with the eruption of the second (permanent) molar teeth; in fact, this increased deepening of the alveolar process is continuous until the third molar has taken up its position."

It would appear that the underlying force which determines tooth eruption, provides also a stimulus to actuate the hormones or allied agents controlling the osteoclastic and osteoblastic elements in much the same way that they are activated by a fracture.

Amongst other things, these hormones appear to be stimulated to activity by pressure thereby enabling orthodontists to secure teeth in new positions. Whether alteration in the topography of bone is limited by age or not I am not in a position to say; but it seems reasonable to suppose that with any alteration in pressure or stimulus there would be a corresponding change in bone contour. If it were not so we should be deprived of the ability to undertake the reduction of such conditions as maxillary protrusion at a later time of life than we are accustomed to attempt it.

I have in mind two such cases, finished six years and three years ago, when the patients were 38 and 56 years of age respectively and in neither of which is there any sign of loosening of the teeth involved or of retrogression to the original condition.

When I became acquainted with the case under consideration I could group it only under Mr. Norman Bennett's classification of malocclusion as a case of close bite primarily associated with a posterior deformity of the alveolus and secondarily with proclination of the maxillary incisors.

In the "Transactions of the British Society for the Study of Orthodontics," 1921, on page 66, at the opening of the discussion of a paper read by Mr. Warwick James, the then President is reported to have said that, "he agreed with Mr. Warwick James that the condition of close bite was one which was only associated with post-normal occlusion, especially in those who were mouth breathers."

Actually Mr. Warwick James was careful to say in the résumé of his paper sent out to us : "*Nearly* all cases (of close bite) are associated with (so-called) backward displacement of the mandible, the jaws and lips not being closed."

In the light of my previous text-book knowledge, I was somewhat disconcerted by the President's statement, so, although I realise that the President probably overlooked the knowledge, common to both of us, of so exceptional a case as this which I am presenting but the like of which has certainly occurred before, it caused me to register with more than usual care certain facts connected with the case.

On page 114 of the 1914 edition of Norman Bennett's "Science and Practice of Dental Surgery," there are excellent reproductions of photographs of models of a similar case.

The case which I present is this.

The patient, a boy, was born during the 16th September, 1911, of Eurasian parentage. The father is a Spaniard of pure descent, the mother a Chinese of Mandarin class. The birth occurred at Manilla in the Philippine Islands.

I saw the patient originally on the 7th January, 1924, when he was twelve years and four months old, and I obtained the models numbered 1.

The conditions noted were these :—

The general physique was very strong and on the stocky side.

There was the obvious harmony between mind and body of perfect health.

The boy was bright, very much alive and highly intelligent.

There was not what is generally recognised as an open mouth, nor was there the slightest appearance of adenoidal facies.

The upper lip rested somewhat high on the maxillary incisors but did not appear in any sense "short."

The lower lip closed behind the maxillary incisors, and it was on account of some possible prejudice this might offer to his general health that the boy's mother brought him to me for attention.

The lips could make contact with one another only by manipulation.

The nose was well developed and the boy breathed through his nostrils at all times. There was no nasal stenosis. There was no mouth breathing.

There was no history of serious illness.

On looking into the mouth I saw that the first permanent molar relationship of each lateral half was normal; that is to say, there was no post-normal occlusion (Fig. 1).

The alveolus of the horizontal ramus was deficient in vertical depth. I neglected to make a note of the ramal angle and at this distance of time regret that I am unable to remember it.

The mandibular second permanent molars had partially erupted but there was no sign of the corresponding maxillary members.

On 9th January, 1924, the models were mounted on an articulator, and I noticed that the anterior relationship looked abnormal, but on

closer inspection decided that it was an illusory appearance occasioned by the proclination of the maxillary incisors. Actually the palatal and lingual borders of the maxilla and mandible respectively bore a normal relationship to one another. The narrowed appearance of the maxilla was illusory too and due also partly to the proclination of the incisors and partly to the instanding of the first premolars.

I do not understand what is meant by the "lengthening of teeth" in cases of protrusion, but in so far as the mandibular incisors in this mouth had erupted to their complete and perfect anatomical relationship to the alveolus about them or they were not lengthened.

This "lengthening of teeth" is a matter I have not yet been able to appreciate, and I would much like to have it explained to me if the condition exists. I can understand a "shortened" tooth as being an incomplete eruption and I can understand fully erupted teeth occupying a higher level than their neighbours by reason of a greater vertical growth of the alveolus about them as compared with the growth about their neighbours, but I cannot grasp this idea of "lengthened" incisors.

It appeared to me that there was only a partial denudation of the premolars and molars, particularly of those of the maxilla, and that there was only a small amount of correlated alveolar growth about them.

The alveolar border behind the canines in both jaws occupied a different level from that in front of them. It was not quite so obvious in the maxilla on account of the canines in that jaw being those of the deciduous dentition and on account of proclination of the incisors.

The mandibular incisors, fully erupted to my conception of their anatomical coronal distance in relation to the gum and alveolar border, impinged on the palate as the models show ; in other words, there was a close-bite.

At first sight I thought that probably little could be done to correct the condition, but when I realised that the maldevelopment was localised about the premolars and molars and remembered that the maxillary second permanent molars had not, as yet, erupted, I felt that an effort should be made to raise the bite.

A condition of caries of the maxillary first permanent molars was treated, the cavities were filled and the tooth contours restored to imitate as closely as possible those of the normal.

On 28th February, 1924, I applied a removal appliance in plate form designed to raise the bite on the first permanent molars and to retract the maxillary incisors by means of a buccal wire having U-shaped sides and an incisal hook.

On account of tilting, it met with only partial success.

In late 1924 I realised the small amount of progress, and that, as the maxillary second permanent molars were erupting, the matter was becoming urgent.

Consequently, on the 5th January, 1925, I cemented on the maxillary first permanent molars gold cap biting blocks of an occlusal thickness sufficient to limit the maxillary incisors to an overlap of one-half the coronal length of the mandibular incisors and to provide what I judged to be the necessary height for the premolars. (Fig. 2.) To these cap-biting blocks had been soldered buccal hooks of a length which could be modified in the mouth without otherwise disturbing the

fixed appliance. These buccal hooks were made of gold wire of sufficient rigidity to withstand the contracting stress of the elastic ligatures which I had in mind to employ and to avoid inward pressure on the premolars. I cemented on the maxillary left central incisor a band carrying a laterally directed groove as near the incisal edge as it was possible to have it and of sufficient depth to maintain an elastic ligature stretched between the hooks. With the idea of preventing any rising of the mandibular incisors with their alveolar support a metal cradle opposing them was originally attached by solder to the caps on their palatal aspect but owing to the immediate septic condition produced between the cradle and the muco-periosteum I cut it off and risked the rising of the mandibular incisors and their alveolus. I very much doubt now if there was any risk of their rising because, as the growth of the alveolus and the denudation about erupting teeth appears to be concomitant, and as the mandibular incisors were fully erupted and completely formed, I think there could not be an upgrowth of the alveolus about them disproportionate to the general alveolar deepening. If it were possible to have the one factor without the other it would be incorrect to speak of concomitance. I am suggesting that localised upgrowth of alveolus does not occur apart from denudation of tooth crown and that, once a tooth is fully erupted and complete, no alteration in height between the jaws at some other point will cause that alveolus to rise out of proportion to general alveolar growth.

I do not suppose that the apparatus I used is anything new, but I have described it and exhibit it for the benefit of any colleague to whom so simple and effective a means of traction has not occurred (Fig. 2).

The boy was given a series of ordinary stationery rubber bands of various lengths—Walker's Grey Bands Nos. 15, 13, 12 and 10—which he applied at discretion, the force employed being controlled by periodontal sensation.

By 17th September, 1925, that is eight months after the application of the before-mentioned apparatus, the second permanent molars occluded and the mandibular left premolars, which erupted after the application of the apparatus but not because of it, occluded with their opponents and automatically suggested the removal of the cap biting blocks and the fixing of a retention appliance. The maxillary incisors were retracted so far by then that lip function was established. Nevertheless, from fear of some lip-sucking habit, of which there never was any evidence, I fixed a retention appliance consisting of a moderately broad flat wire soldered to bands cemented on the maxillary second premolars.

The first permanent molars were given uninterrupted opportunity of coming into occlusion.

By the 9th December, 1926, as the occlusion was practically ideal, as shown in the models numbered 2 in the table, I removed the retention appliance and allowed the musculature of the parts to round off my work.

Fillings were inserted in the mandibular first permanent molars during late 1928, and after highly critical examination I have failed to find any further cavities.

On the 2nd August, 1929, two years and eight months after the removal of the retention apparatus, I obtained the models numbered 5. (Fig. 3.)

Fig. 1

Fig. 1

Fig. 1

Fig 2

The mandibular left second premolar is in dorso-occlusion, but I was reluctant to attempt its rotation on account of the possibility of creating some circumstance prejudicial to what is otherwise an " ideal " occlusion.

The gums are perfectly healthy all round the mouth and the teeth have suffered no damage from the appliances used.

The boy, now aged 18 years, is a splendid specimen of young manhood and is not feeble in either bony or general development.

I have had in my care the father, five elder and younger brothers, the father's brother and a nephew on the father's side of European blood.

On the Asiatic side I have seen only the mother.

With the exception of the two youngest boys, aged 8 years and 6 years, all these members have normal occlusion.

It is not possible to classify these two boys yet with any certainty, but for the time being I have grouped them as close-bites with post-normal occlusion. Tonsillar enucleation was performed in July last for the youngest boy, aged 6 years. He is a feeble child who weighed, on the 26th September, with his shoes, socks, knickers and shirt, less than two stone and twelve pounds avoirdupois.

I give a tabulated set of figures showing the length of the crowns of the teeth in millimetres measured by dividers on the successional models numbers 1 and 5 (Figs. 1 and 3). Models 2 and 3 are not illustrated. Each figure is the mean of three measurements. Even after allowing for the slight trimmings at the cervices, which was done before any idea of measurement occurred to me, I think the figures may be accepted as representing actual eruption. All of the incisors were measured on the lingual side whilst the molar teeth were measured on the buccal aspect.

Fortunately, the lingual cervices of the mandibular incisors, to which no force was applied, were not trimmed and as these lingual measurements in the mandible are constant I feel that they go to support my belief that physiological teeth do not rise in the alveolus once they have fully erupted and become complete.

It can be seen from the table of figures that whereas the lengths of the second permanent molars in models 2, and in 5 (Fig. 3), are individually constant, those of the premolars increased from the time of models 2, when it will be remembered no apparatus was present.

Coronal Measurements in Millimetres.

Models 1 and 5 only are illustrated (Figs. 1 and 3).

Side.	*Tooth.* Lower.		*Model* 1.	*Model* 2.	*Model* 3.	*Model* 5.
Left.	1	lingual	8.5	8.5	8.5	8.5
	2	do.	9	9	9	9
	3	do.	7	9	9	9
	4	buccal	unerupted	7.5	8.2	8.5
	5	do.	do.	7	8	8
	6	do.	6	8	8	8
	7	do.	5.5	6.5	6.5	6.5
Right.	1	lingual	8.5	8.5	8.5	8.5
	2	do.	9	9	broken	9
	3	do.	7	8.5	8.5	8.5

RIGHT.	4	buccal	7.5	8.2	8.5	8.5
	5	do.	7	7.2	7.75	7.5*
	6	do.	6	7.5	7.5	7.5
	7	do.	5.5	7	7	7
	UPPER.					
LEFT.	1	palatal	11	broken	11	11
	2	do.	9	9	9	9
	3	do.	unerupted	9	9	9
	4	buccal	5.4	7.5	8	8
	5	do.	6	6.5	7.2	7.5
	6	do.	6	6	8	8
	7	do.	unerupted	5.5	5.5	5.5*
RIGHT.	1	palatal	11	11	11	11
	2	do.	9	9	9	9
	3	do.	unerupted	9	10	10
	4	buccal	5.5	7	8.5	8.5
	5	do.	5.5	6.5	7	7
	6	do.	5.5	6.5	7.5	8
	7	do.	unerupted	5.2	5.2	5.5

A comparison of the models shows the further eruption of the premolars and molars and the deepening of the alveolus, and it is evident that some of this eruption and some of this deepening has occurred since models 2 were made. If a sight is taken of the lingual aspect of the occluded models 2, and models 5 (Fig.3), it will be observed that more is seen of the palatal surfaces of the maxillary incisors of models 5 (Fig. 3) than of models 2, and that whereas in models 2 the mandibular centrals impinge on the central tag of palatal gum, in models 5 (Fig. 3) they are clear of it.

The original close-bite of models 1 was artificially raised on the first permanent molars.

It was still present to a small extent at the time of models 2.

In models 5 (Fig. 3) it is absent.

These facts taken together with the increases of coronal lengths suggest that there was much more upgrowth of alveolus with the teeth in the molar regions, and more particularly in the premolar regions than in the incisor region.

Since reading Wallace I have wondered whether the second permanent molars would have erupted sufficiently to raise the bite and whether the development of the alveolus and teeth in front of them would have occurred naturally to the correction of the original condition as part of the special bone activity proceeding at the time of the eruption of those molars.

The PRESIDENT remarked he would be glad to hear a discussion on this interesting case. He thought an operator was very fortunate in being able to treat cases of —he thought Mr. Eady said—38 and 56 years of age without producing any untoward results, and still retaining the teeth perfectly firm in their sockets. From the apparatus which was used, as far as it could be understood, Mr. Eady was to be congratulated on not having produced a condition of prenormality of the maxillary molars. These, very often, were drawn forward as much as the incisors were drawn back by such methods as the essayist had employed.

SOMETHING ABOUT POST-NORMAL OCCLUSION.

By G. F. Cale Matthews, L.D.S.

During last summer the *Daily Mail* had a National Photographic Competition to decide upon the most beautiful child in England and the most beautiful children in the different counties. In looking through the pictures illustrated in the paper it seemed to me that a majority of these children had post-normal occlusion. There were many of the dominating factors in the photographs—small chin, receding lower lip, and an anxious expression which even the photographer, with all his skill, has been unable to eradicate. If we take these thousands of children as representing the standard of beauty to-day, what are we as orthodontists to gather from this lay acceptance of what we regard as a deformity?

I want to take as my thesis to-night that post-normal occlusion is the most difficult and outstanding problem which the orthodontist has to solve. Is it an increasing condition? if so, why? Have modern conditions of living any responsibility in creating the deformity? Is heredity a prime factor and the most important in its production? Is its production due to excessive development of the maxillæ in the one type, owing to reduction of maternal feeding, and has the English language correctly and pedantically spoken a responsibility for a lack of ease in facial expression, and has the careless ill-spoken lipless enunciation of the modern child become a factor? Or is it entirely due to lack of development of the mandible?

Can we look to any racial characteristics of true and clear breeding to help us in the solution of this problem? I have been interested to notice amongst my Jewish patients much more irregularity in the present generation than there has been in the past. That is only an observation and I advance it only as such, but we have in that race a marvellous conservancy of habit and custom; they are clean-living people, carefully bred, and it may be worthy of consideration as an aid to our investigations of this problem of post-normal occlusion. Are they, too, suffering under modern conditions?

Textbooks, whilst devoting a considerable amount of space to considerations of treatment by standard appliances, dismiss very lightly many of the difficulties which confront the practitioner. One such devotes some thirty pages to etiology and two hundred to appliances. If we read them correctly we are led to understand that there are two classes: the one type mouth breathers, the other type normal breathers. A systematised method of treatment will definitely and permanently relieve both conditions. Either we are not sufficiently skilful to follow the instructions laid down, or the authors are incorrect in their statements. It is an easy matter to improve the appearance and give a greater efficiency to the average post-normal occlusion in a comparatively short time, but it is not an easy matter to stabilise the amount of correction which may be obtained.

May I quote from a paper I read in 1926 in New York on "The Complete Deciduous Dentition at the Eruption of the First Permanent Molars," in which I endeavoured to show by a series of models how narrow is the margin between a correctly developing permanent dentition and a post-normal one.

We know that at birth the crowns of the deciduous incisors, the cusps of the canines, and the masticating surface of the molars are calcified; also twenty-four of the germs of the permanent teeth are present, and the first permanent molar has begun to calcify.

Here are all the elements of a future developing malocclusion, if we realise the various factors which may operate in development in the next twelve years, i.e. to the eruption of the second permanent molars and the completion of the denture from the orthodontist's clinical side.

Again, at the completion of eruption the child has passed the stage of infant care and nurture; he is able to take the ordinary food provided, and under primitive conditions could forage for himself.

From the third to the sixth year there is a remarkable condition of things. The permanent tooth germs are gradually calcifying, and are in varied degrees of crown completion, according to the period of their sequence. The first permanent molars are complete in crown and half of their roots are formed; the crown is only covered by gum, the crypt being fully open; the second permanent molars are well on their way, and the crown is almost completely calcified. These latter are both behind and independent of the deciduous teeth.

All this time great stress and strain have been placed upon these deciduous structures, which, despite the wasting of their roots, are fulfilling their functions of guiding their successors and disappearing from below upward, so that their ultimate fate is one of voluntary and easy quittance, which should leave their successors exposed, and eager to take their places.

It is both a wonderful and instructive indication of law and order, and leaves us just where we were at the beginning as to how all this happens. We have no definite knowledge of the actual forces of eruption, and there is no other development from which we can make comparison.

It is obvious that the additions which have occurred in the change of the internal arrangement from germ to calcified crown must have more room and strength.

The mandible, by its simpler and more definite alignment, affords an easier illustration than the maxillæ. It has added to its depth, length, and width. Bone has been deposited beneath; it has grown anteroposteriorly, and the body of the bone has also increased laterally. The alveolus is greater, and its flow must have synchronised more rapidly than the growth of the body bone. Brash has clearly shown, and it has been my privilege both to see and to handle his madder-fed specimens, that as growth occurs, the teeth move forward as well as vertically, the position of the sockets of the anterior roots of the molars are ultimately occupied by the posterior roots, and so on right through. Whereas absorption occurs in the angle of the mandible, to give space, there is growth or deposition behind to give strength. However, the main interest to the orthodontist is, that while these changes are occurring, *the occlusal plane remains unaffected.* There is increased depth from the occlusal plane to the lower border of the mandible, but both the deciduous teeth and the first permanent molars are in occlusion; and this condition

will be maintained until the loss of $\overline{e\ d\ |\ d\ e}$ when their responsibility will be taken over by $\overline{5\ 4\ |\ 4\ 5}$.

The normal occlusal plane at the end of the sixth year, or at the eruption of the first permanent molars, is inclusive—the distal surfaces of the e's being level vertically, yet the molars are gradually adapting themselves to such a position that they may attain cuspal relation, in which the anterior cusp of the $\overline{6\ |\ 6}$ is anterior to that of $\underline{6\ |\ 6}$.

This accommodation may be due to the occlusal plane adopting an upward curve, slight but of sufficient degree so that the distinct cuspal shape of the upper and lower molars may fulfil their greatest efficiency. At any time after this, by the forward flow of the alveolar border, together with the action of the curve, the lower molars are taking up an anterior position, and are in a relation as described by "normal."

If this is so, how does a distoclusion develop in the relation of the permanent first molars which has no bearing on the jaw relationship, as indicated in the temporary occlusion? It can only be by:

(1) Premature eruption of one or another of the molars. The premature eruption of a first permanent molar, rising above the occlusal plane of the deciduous dentition, may so stabilise its position as to prevent the full eruption of its antagonist.

(2) An unusual *levelness* of the occlusal plane. The effect of a perfectly level plane of occlusion embracing the first permanent molars may give a point to point cusp occlusion, which may then develop medially or distally.

(3) Failure at the physiologic moment of a cusp lock. It may be that the correct relation of an anteroposterior occlusion of the first permanent molars is brought about by a slight backward and vertical growth of the upper molar; this back and upward or downward growth may also fail.

(4) An interference with alveolar growth anteriorly. There is evidence that the "alveolar flow" must accommodate itself to the growth of the permanent teeth within the body of the bone. Any interference with alveolar growth will cause displacement of the teeth *within the alveolus*.

So far as I have been able to find out, very little work has been done on the articular relationship of the mandible at birth. I think it could be definitely said without contradiction that there are, and must be, many variations in the position of the mandible at this time. Examination of stillborn children and dried specimens of full-term children give one the impression that at this period the mandible is in a more or less backward position. This is a matter for research work which should prove of great value to us. If, as I hope to show later in the evening from slides that the margin between a normal relation of the mandible to the maxillæ as demonstrated by the occlusion of the teeth is a very narrow one, it is possible that very many extraneous factors may be responsible for the condition which we know as post-normal occlusion. It may be simply a coincidence of practice, but during the last three months I have not seen a new case of a normal relationship of the first permanent molars. They are either in postnormal relation, due to premature loss of temporary dentition, or are naturally post-normal due to

some other cause. I think before we are satisfied that the means we employ are definitely correct in establishing a permanent correction, more knowledge must be gathered as to the deciding causes of this condition.

It will be well to recognise some of the factors which I think are unassailable. In the forefront I place heredity. To establish this point one has to be very careful in taking the history of cases. It so often happens now, owing to the progress of medical science, that the majority of mothers some of them very young, are edentulous, and whatever opinion they may advance in regard to their own natural dentures we are not able to gather from their appearance any definite help, but it does happen that occasionally the maternal evidence alone is incontrovertible, and if that is not so we have very few opportunities of observing the father. If the responsibility can be placed upon the father or his side of the family, you may be assured that it will be, most definitely and gratefully.

During the last two years I have been endeavouring by an exhaustive chart to establish some sort of record regarding feeding. This is exhaustive both from the maternal side and from the child's side. The maternal feeding is taken during the whole time of pregnancy with a view to discovering whether diet can have any possible influence on bone growth and bone formation. In the case of the child careful questioning will elucidate many anomalies in regard to child feeding. Whether this will ultimately have any real value I do not know, but so far it is borne in upon me that the great majority of children with post-normal occlusion are artificially fed. On the other hand, occasionally a setback in a very severe case comes along where the child has been breast-fed for a considerable time—nine to twelve months.

I have referred to the definition as given in the textbooks. We are all familiar with the various causes given for this condition—adenoids, tonsils, lip or finger sucking, mouth breathing, the rubber teat, premature loss and retention of deciduous teeth, supplemental teeth—all these may have a place in materially increasing this condition, but are any of them the actual cause? Pressure on the anterior portion of the mandible at an early age would be more likely to depress the particular portion where the force is applied and to materially affect muscular resistance, which would naturally oppose any anterior force. If the pressure is applied to the intermaxillary bones by palatal pressure, such as thumb sucking, it is very obvious that they will be forced forward and produce what is known as a superior protrusion. The two conditions, that of superior protrusion and post-normal occlusion, are entirely distinct although confusion still exists and the one is often misread for the other. How are we to account for the apparent sudden change from a normal temporary occlusal relationship to a manifestly and rapidly developing post-normal occlusion in the permanent dentition? If there is any premature loss of deciduous teeth the reason is at once clear, but in those cases where the deciduous dentition is maintained until the eruption of the first permanent molars and they suddenly develop a post-normality, it may be, as I have endeavoured to show on previous occasions, that the curves of eruption do not immediately synchronise and that a miscuspal relationship may be quite sufficient to retard the occlusal development of one or both

permanent molars. If this should be so the mischief is at once established, and the margin of security is such a very narrow one in a perfectly occluding temporary dentition.

I have come to this point a little quicker than my earlier argument allowed because I want to emphasise and to ask for observation on this point of maternal feeding. It must be quite obvious that if Nature provides a natural food for an infant and that natural food is denied, it must suffer in some respect. Is it retarded more in its mandibular growth and development than in any other part of its body? Those who are fortunate enough to have been able to observe their own infant being naturally fed must be impressed by the fact that it has to work for its living. It is not intended that its food should be simply poured into its mouth. Another point that is not sufficiently emphasised is that the human nipple is of an extraordinary size when distended and will practically fill the whole of the child's mouth, and the milk is discharged almost directly into the pharynx. This, combined with the extraordinary muscular force necessary to extract the milk, and the resistance and elasticity of the mother's breast, all cause a great amount of muscular force to be employed and developed. With this there must be complete nasal breathing, but even then it will be observed that the child has to take short periods of rest and refresh for another onslaught. There is nothing strange in this. It is a provision of Nature, and to-day it is very largely neglected. I know no prouder woman than the mother who tells you that she has been able to nurse her babies. If the lack of this method of feeding is an aid to post-normal occlusion then it will be very obvious that the condition is going to rapidly increase.

We have not sufficient data to determine definitely the average relationship of the mandible to the maxilla in the temporary dentition of the modern child. Much work will have to be done in that field before it can be definitely stated as to the percentage of post-normal occlusions in the temporary dentition.

May we for a moment consider the accepted types according to our textbooks? We have bilateral post-normal occlusion with proclinated upper incisors, excessive overbite, possibly retroclinated lower incisors—usually associated with mouth breathing. The unilateral post-normal occlusion associated with the same breathing conditions—that is known as Division I, Class II of Angle's classification. Division II—post-normal retroclinated upper incisors—normal breathers.

It is quite easy to demonstrate the effect of a complete stenosis on the action of the lips, tongue and the position of the mandible. Immediately the nostrils are closed, the tongue usually falls into the floor of the mouth, air is sucked into the vault of the palate, the lips are more or less widely apart and there is no muscular control of the air force in the maxilla and lack of the tongue force in the mandible. These cases can be materially helped before treatment by restoring normal breathing.

It is not quite so easy to demonstrate the reason for the second division of this big class. It must be a mechanical condition within the mouth caused by the peculiar obstruction and consequent locking of the incisor teeth, together with a very great muscular pressure of the lips. If allowed to progress there is definite lack of vertical growth in both of these classes.

There are other types of post-normal occlusion which I call pseudo, and they are those which correct themselves automatically when the obstacle is removed. Many of the established cases of Division II, Class I of Angle may have resolved themselves had they been observed sufficiently early to determine the cause and development of the obstruction.

Before proceeding to any further elaboration of cause I would like you to observe the varying types of temporary dentition in the following slides and to note as quickly as possible the suggested results in the permanent dentition. It will be seen that in these few cases there is considerable variations in type, and many possibilities of distinct development in the permanent dentition. I know that I am not in accord with the opinion of some eminent orthodontists, our President for one, but such is my opinion at present on the observation of very many temporary dentitions, with the advantage of being able to follow in some cases the gradual building up of the permanent denture.

In this month's *British Dental Journal* the following note appears: "According to the descriptions given in anatomical textbooks, the interarticular cartilage of the temporo-mandibular joint is thickest posteriorly and thinnest in the centre, which may be perforated, in which case the synovial cavities may communicate. Mr. C. P. G. Wakeley, in the course of an article on 'The Causation and Treatment of Displaced Mandibular Cartilage,' in the *Lancet* for September 14th, states that this description is incorrect. He has examined over fifty specimens of the mandibular fibrocartilage in the Anatomical Department of King's College, and finds in all cases that it is thickest in the centre and anteriorly. The posterior part of the cartilage is very thin and passes down behind the posterior surface of the condyle and fuses behind with the capsule. So far from the cartilage being perforated in the centre, Mr. Wakeley has never found a cartilage with a perforation either in young or old subjects. He goes on to state that the anatomical description to which most of the textbooks conform appears to have been handed down from generation to generation without anyone having taken the trouble to verify it. Since an understanding of the complex movements of the jaw is of practical importance to the dentist, it is as well that this correction of an anatomical error should be made." I have not read the article in question, but if this is so it may be of value to us in our endeavour to understand the possibility of change in the temporo-mandibular joint which we may endeavour or be able to produce by mechanical treatment. In the course of conversation with Professor Fawcett some years ago at the Bath meeting of the B.D.A., he gave me immense encouragement by endorsing and emphasising my opinion that the articulation can be changed by careful and judicious treatment at a time when growth was rapidly taking place, i.e. when treatment was adopted in accordance with biologic and physiologic growth, which is the term used by our confrères in America to describe normal growth.

Whilst heredity may be the great factor in post-normal occlusion, are we to assume that it is consequently untreatable? Where heredity is the dominating cause it will frequently be found that opposing any treatment is the imitative faculty in the child. It is a difficult and sometimes hopeless task to treat a child who is constantly in

association with its mother, if she be suffering from the same condition ; and care should be taken to advise, that anyone having the care of a young child with post-normal occlusion should be free from that condition, if obvious.

I hope I have made it clear from the foregoing that the question of diagnosis may not be so simple as appears on the examination of models, and how unwise it may be to advise a treatment without a very thorough knowledge of the history and an interview with the child.

With all the speculation as to a successful issue of treatment, it should be remembered that developments of the maxilla, mandible and even the skull itself are not bilaterally equal in every case, but may possibly be so in those where correct occlusion is obtained and maintained. Wadsworth, in his work on prosthetic occlusion—and Kirk's final research and the completion of the articulator—is satisfied that the occlusal plane is not equal on both sides in many instances. The conclusions to be come to in regard to the heredity factor is, that while neglected it may be intractable, still if early treatment is applied and any other influences are removed, there is no reason why development should not proceed on normal lines.

Textbook treatment is both dogmatic and simple. Use a certain type of appliance and all will be well. Divesting these simple instructions and satisfactions of their cocksureness, and basing our treatment on the lines of the forces indicated, we shall achieve a measure of success. It is those cases which approach so nearly to a normality which are the anxiety to the orthodontist. This summer it has been my good fortune to meet some eminent practitioners. They are full of enthusiasm, quite assured that the science is progressing and that we are making headway. Unquestionably their results warrant this enthusiasm, but it must be remembered that these men live and sleep orthodontia, it dominates their whole lives, but, and this is an important point, they are unanimous that no standard stereotyped treatment can attain the same results in every case. Individual consideration and study must be given to every case. Success in the hands of one does not mean either success or even usefulness in the hands of another. The danger in orthodontic practice is the non-recognition of the personal factor. The wise man carefully chooses his methods, recognising his limitations, and acts accordingly. If he consistently studies he must make progress and attain success.

I am supposed to be speaking of the treatment of post-normal occlusion ; so far I am afraid I have been very desultorily wandering. I find that there is so little to be said of treatment that cannot already and more effectively be gained from current literature.

In our schools are demands for treatment. The student's syllabus is an exacting one, and the time he can give to study and practice of orthodontics would often be better bestowed on another study. An elementary knowledge may be sufficient to allow a student to pass an examination, but it may be also sufficient to place him in a very difficult and anxious position if he undertakes a case beyond his knowledge. Therefore the question of forces to be used is one of importance. In this country the removable appliance is in greater favour than a fixed one, and I think this is good, because if it is inefficient no harm may arise, whereas had it been a fixture something quite unexpected might happen.

In those cases where maxillary expansion is desired with retraction of the incisors, the plate with a buccal wire and the expansion screw (Badcock) can and does effect improvement. It must be carefully constructed to give the maximum expansion with the minimum of tilting. It is not quite so efficient in the mandible. Care should be taken to note the position of the canines as they are so frequently the obstacle to finally prevent the forward movement of the mandible. Having obtained sufficient expansion, the addition of an inclined plane should (and will) bring forward the mandible as desired, providing always that the demands are not beyond the child's comfort and intelligence. Individual tooth movements which may be associated with treatment are difficult to carry out with this type of appliance; but as a simple and preliminary method in a complicated case, and as a means of correcting a simple and tractable condition, it is worthy of a place in the forefront of removable appliances.

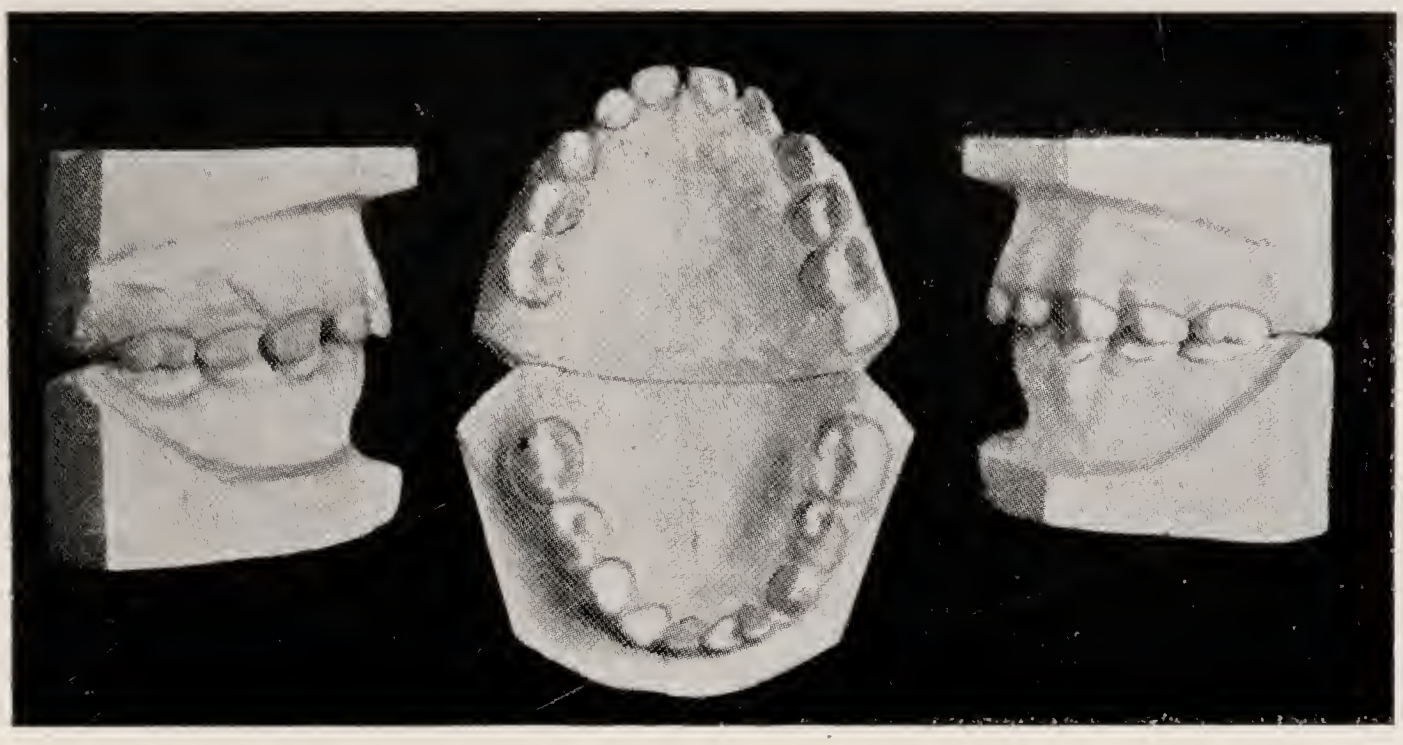
This same result may be obtained by appliances fixed to anchorages. You are all acquainted with the methods employed in what is known as intermaxillary traction. The commercial appliance should be at once condemned, unless it is modified to the individual case. Anchorage on molar teeth, either temporary or permanent, with buccal wires and elastic ligatures applied, may and does lead to disaster, unless care is taken to stabilise the anchorage. It is better to make an individual appliance on the following lines. Bands should be swaged, by any method chosen by the operator, either direct or indirect. I prefer the direct method. An impression is taken with the bands in position and the appliance built up on the model. In doing this it is wise to consider any additions which may become necessary in the treatment and to attack these, if not too complicated; at the start. It may be a great saving of time in the future. The regular type of appliance should be made of platinised wire, 19-gauge, fitting exactly into buccal tubes of the same platinum alloy.

Palatally and lingually this same gauge wire should be used to stabilise the anchorage. Individual tooth movements may be obtained by finger springs attached to either the internal or buccal wires. These internal bows may be rigidly soldered to the anchor bands or applied by any "lock" with which the operator is familiar, and if it is necessary to supplement with finger springs, these can usually be adjusted for some time without the appliance being removed. The position of the points of attachment of the elastic force is far more important than is generally supposed. Every care must be taken to prevent the elevation of the anchor tooth (unless desired). Posterior elevation may lead to open bite. Anterior elevation may remain permanent. Sometimes it is desirable to further stabilise by attachment to the lower incisors; this is to be avoided unless alignment of individual teeth is a part of the treatment. If preferred the internal expansion may be obtained by the opening of loops in the bow, which have been provided for this purpose.

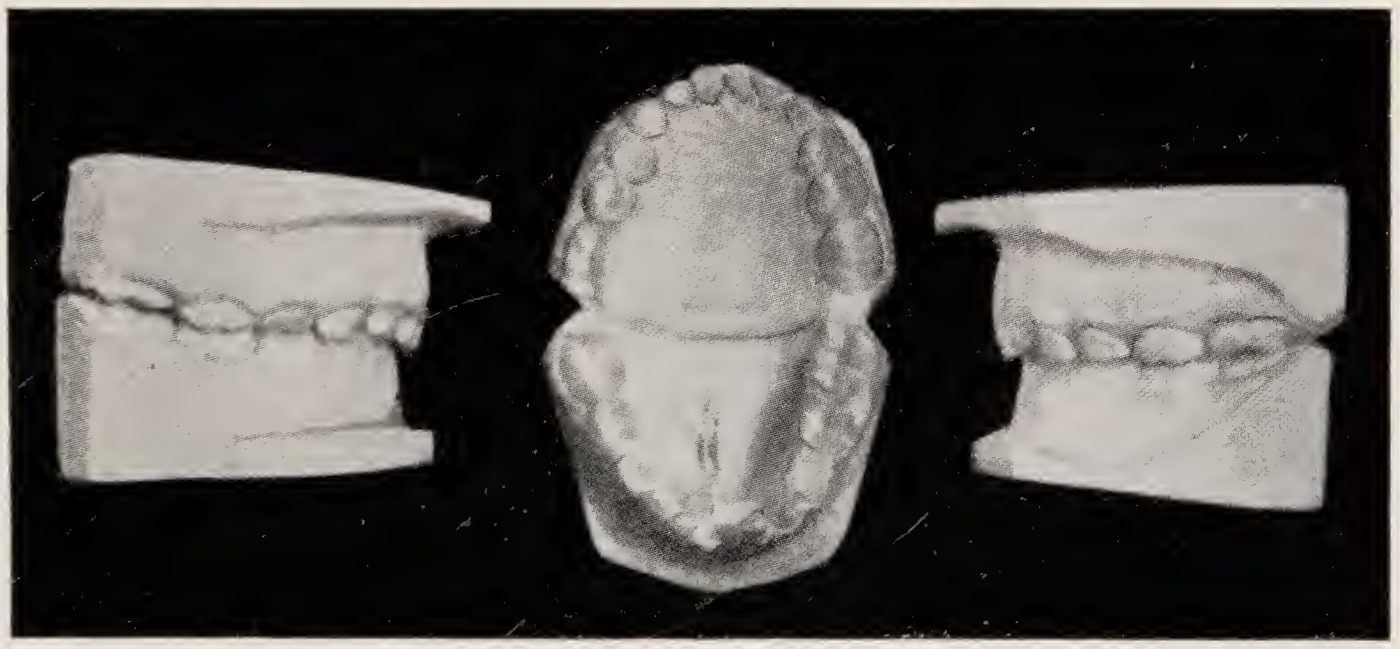
The fitting of the anchor bands is very important and provides a definite technique; under no consideration must they be allowed to interfere with occlusion. Regarding the use of finger springs, to-day I suppose the finger spring is the most popular method. It is also very dangerous and disappointing. The utmost care must be exercised in its manipulation and placing. I have seen disastrous results from a wrong use. It can depress teeth if allowed to rise above the vertical

SOMETHING ABOUT POST-NORMAL OCCLUSION.

By G. F. Cale Matthews, L.D.S.



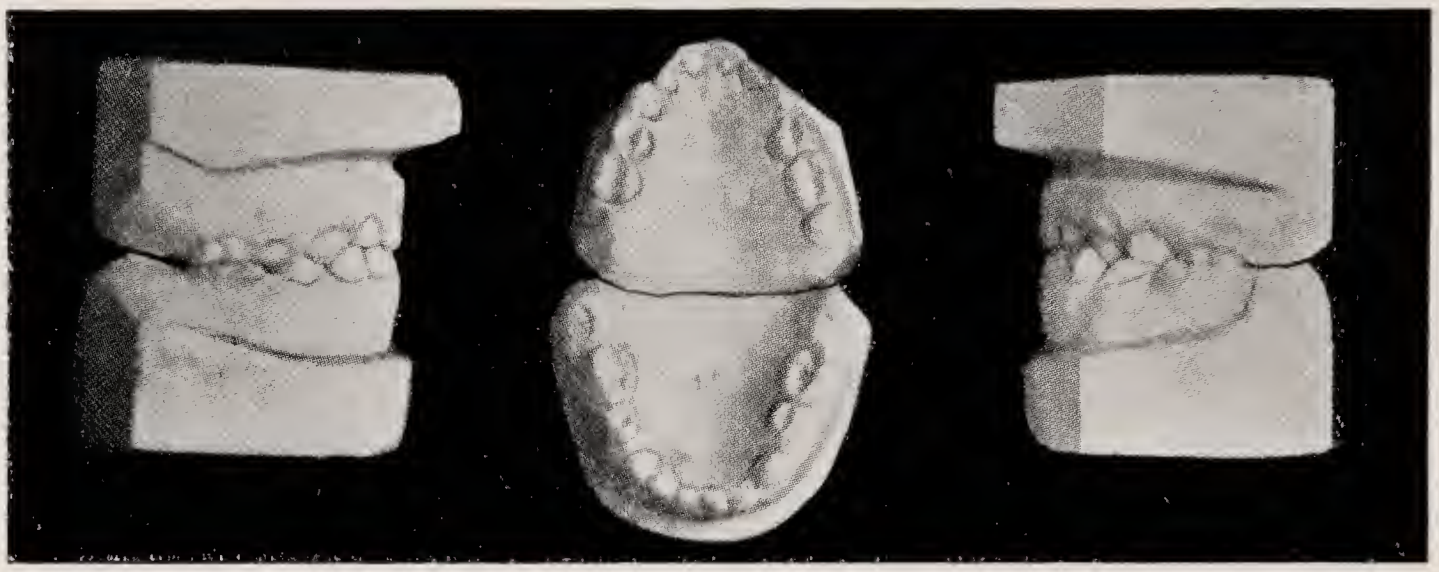
Good occlusion. Prognosis for permanent occlusion good. Excellent spacing. Open bite depth " correct." Age $6\frac{5}{12}$.



Good arch development. Unilateral distoclusion $\overline{1}\,|$ in linguo-version. Temporary incisors lower small, $\overline{1}\,|$ large. Prognosis of permanent occlusion. ? Crowded anteriorly. Age $6\frac{4}{12}$.

SOMETHING ABOUT POST-NORMAL OCCLUSION.

By G. F. Cale Matthews, L.D.S.



Unilateral distoclusion | b, c, d, e, in linguo-version, c, b, a, | a, b, c, gradually narrowing. ? Distoclusion of left side caused by the linguo-version of | b, c, d, e.
Age $5\frac{7}{12}$.

Bilateral distoclusion. Some spacing between c, b, a, | a, b, c. Excessive overbite. Age 4.

lingual curve in the lower incisors and upper incisors, producing the appearance of an open bite. It can also cease to act, and the resultant condition is one of stasis if left too long. Its displacement can give extreme discomfort. With these two methods, one, the use of an expansion plate, supplemented with the necessary forces, and the fixed appliance carefully thought out and applied, we have the means of mechanical control to effect a successful treatment. If this is so—and we know it is, because we can all show cases which have given us satisfaction—why is it that these treatments are not universally successful? I hope some of you can give the answer. My own opinion is that we have missed something in our diagnosis and treatment; it may be a minute factor but nevertheless a dominating one. I firmly believe that there is often a psychic influence which makes for success. It is definitely and absolutely impossible for one man to treat every case successfully. He may be opposed temperamentally, and success cannot come without the entire co-operation of all concerned, and not least of these are those in charge of the child. Opposition or diffidence there, may be the greatest stumbling-block.

I cannot close without mentioning the valuable help I have received from Dr. Rogers. The exercises advised by him are of immense assistance, but I have not yet had the confidence to apply those of them I know without the aid of mechanical appliances. Here, again, I think is a definite personality which obtains a control unconsciously.

Just one word on extraction as a part of treatment in post-normal occlusion. Extraction must play a justifiable part in the treatment of complicated cases. It may shorten treatment, and where appearance is not so important as occlusion a result will be obtained to give satisfaction. But I do not yet understand the reason why the old shibboleth of equilateral extraction of the premolars is still carried on. Why are the first lower premolars removed as well as the upper in so many cases? The position remains unchanged, except the child has lost four teeth instead of two, and the correction of the case is just as difficult. By all means let teeth be removed if treatment by any other means is impossible, but let a differentiation be made in the correction of a post-normal occlusion and that of an overcrowded dentition.

I think it wiser to see if progress can be made with a complete dentition, carefully studying the possible development of the child, and to decide later if extraction will aid and then if possible to remove a second molar on its eruption and so prevent the possible impaction of the third molars. I regard a well-developed premolar as one of the most valuable teeth in maintaining the forward occlusion of the mandible.

Until greater knowledge is gained on the temporo-mandibular articulation of the mandible and the growth of bone and the influence of applied forces to bone, although we shall have many successes, the lines on which we work are more or less empirical.

To sum up the question of post-normal occlusion and its treatment, we can allow that the mechanical means at our disposal are efficient if a correct diagnosis is made and every assistance is given.

In those cases where little progress is made, where are we to look for our failure? Do we attempt the impossible where some unknown anatomical defect forms the hereditary factor? Allied to this

is the unconscious imitative instinct in the child which passes unnoticed in its environment.

Is the incidence of nasal stenosis the cause of post-normal occlusion or the sequel? The conditions of dental practice in this country at least have not in the past assisted the solution of the problem, as few children can be observed until the condition is definitely established. Theoretically, the condition of occlusion or correction should be maintained without lengthy retention, if the treatment has accorded with natural forces, and it is possible that those cases which give no cause for anxiety in this respect are those which have accorded with these forces. At present the knowledge at our disposal is largely based on data gathered from treatment, and treatment is not wholly given on a definite scientific basis. This must be the method of research in any new branch of orthopædia. Results must come from experience. The anatomist, the physiologist and the orthodontist must work together, collating, gathering and recording. Meanwhile we are doing something for the younger generation by improving both their health and appearance, and if we are unable to guarantee 100 per cent. success that is no reason why we should be discouraged with 95 per cent. The joyous, cheerful, healthy child, alert and inquisitive, large laughing mouth, is the one in whom success will be obtained. I always look askance at the quiet, exact, small-mouthed, tight-lipped child and wonder.

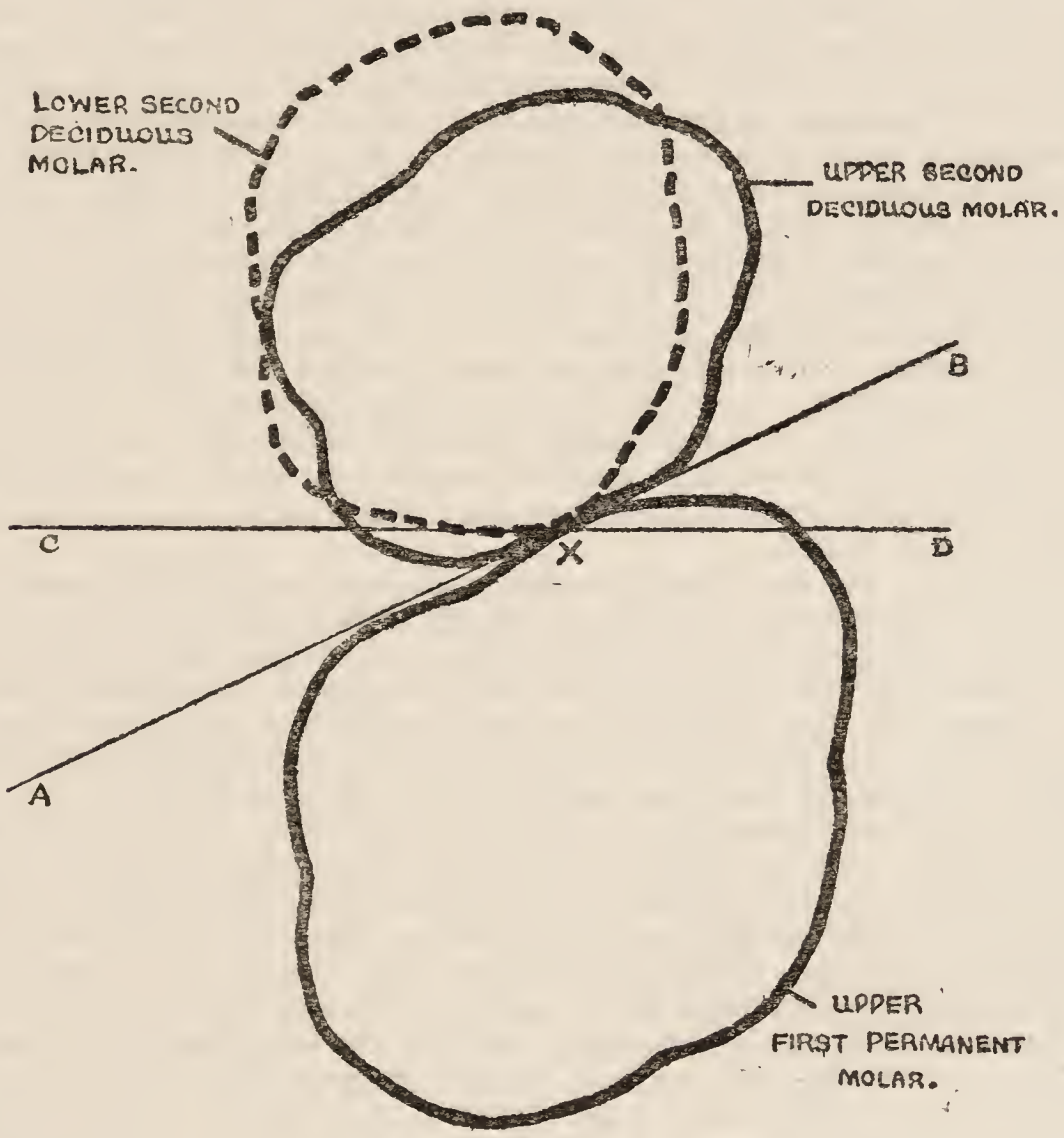
Discussion.

The President said it seemed that Mr. Cale Matthews did not sufficiently recognise the extraordinary frequency with which post-normal occlusion occurred in the deciduous dentition; and he seemed to lay great stress on the fact that post-normal occlusion so frequently occurred at the time of the eruption of the first permanent molars. That, the speaker thought, was much rarer than was the other condition of post-normality in the deciduous dentition. Mr. Cale Matthews agreed with Dr. Friel in thinking that the correct occlusion of the deciduous dentition was a flush occlusion of the second deciduous molar. That he, Mr. Northcroft, still strenuously denied; he was prepared still to think that the correct or ideal occlusion was where the maxillary second deciduous molar projected somewhat beyond the posterior surface of the mandibular deciduous molar. Mr. Cale Matthews said it was very uncertain as to the occlusion of the jaws at the time of birth or *in utero*. Weinberger, it would be remembered, did a good deal of research on that point, and the speaker showed, in his 1924 Board Lecture, some specimens of fœtuses which illustrated marked differences of occlusion; some were obviously post-normal, and others, as far as one could tell, were normal. Odontologists were very fond of talking about inheritance as if it were a cause of malocclusion. It must be remembered that if one inherited a defect from a parent, that fact was not the cause of the defect, it was something further back than that. The question of cross-breeding was a different matter from saying one inherited a post-noraml occlusion because one's father or grandmother or other ancestor had post-normal occlusion. What one wanted to get at was, what gave our grandparents post-normal occlusion? Not why it happened to be inherited by their descendants.

Mr. Marsh said that Mr. Cale Matthews had interested him very much when he was referring to the periods of increased activity in the growth of different parts of the bones of the jaw, and he had been interested in looking out for cases which would fit in with an opinion he had formed some years ago, and which he once mentioned at a meeting of the Society: that in little children, illnesses which were accompanied by a long-continued pyrexia, particularly such illnesses as dysentery or diarrhœa, might interfere with the growth of bone and be a marked factor in the production of post-normal occlusion. He had in mind three cases which he had been able to find out a good deal about, and which he would now like to refer to. One was a boy, aged 14 years, who had infantile diarrhœa at three years of age. He ran a high temperature for three weeks, and had a

temperature of a little under 100° for a further three weeks. The boy suffered serious debility because of this serious illness for at least a year following. That child was breast-fed for nine months, and neither of his parents had post-normal occlusion, neither of his four grandparents, who had been known to him, were cases of post-normal occlusion. One grandfather was a case of pre-normal occlusion. The child he was referring to began, at 4 years of age, to show indications of lack of growth of the mandible, and a dropping backwards of the occlusion of the mandible and of the deciduous dentition at that age, and he was now a case of post-normal occlusion, with no superior protrusion whatever. The next boy of whom he was thinking was now 13 years of age, and was born in China. He was an English boy, the son of English parents. His mother was a big, upstanding woman, with normal occlusion, the father was a well-developed man, with normal occlusion. He asked for and had obtained photographs of all the grandparents, and, as far as his judgment went, none of them showed an underdeveloped mandible. This boy's case was not a superior protrusion, but a case of definite under-development of the mandible. He had dysentery in China when 5 years of age. He had a severe pyrexia for a fortnight, and his mother's remark was that he did not get over it properly for two years. The third boy was now 13 years and 9 months, and his case was exactly similar. He had infantile diarrhœa at 12 months old, and showed practically the same phenomena as the other two.

Dr. Sheldon Friel supported Mr. Marsh in his statement about infantile diarrhœa having a very marked effect on growth. Some years ago the speaker,



in conversation with Dr. Tweedy, late Master of the Rotunda Hospital, gathered from him that infantile diarrhœa interfered with the calcification of the teeth and that such cases suffered in later life from extensive caries. Of the cases which Mr. Cale Matthews showed on the screen, and of which he said the prognosis for the development of normal occlusion was good, all but two appeared, Dr. Friel thought, to be inferior post-normal arch relationship cases. The age of these cases was about 6 years, and in all the cases except two the occlusion of the deciduous molars was the same as that at three years of age. No forward movement was apparent. In the two cases that he thought were normal for their age the cusps of the deciduous molars were worn down and the lower teeth had come forward in relation to the upper teeth. As far as he could judge from the lantern slides,

the cases where the lower teeth had not come forward, the cusps were not worn. This non-wearing of deciduous teeth was a very definite obstruction to the development of normal occlusion. Dr. Friel was sorry that he had not been able to convince the President regarding the relation of the distal surfaces of the deciduous second molars at 3 years of age. Probably their differences were more imaginary than real, due to their interpretation of flush distal surfaces. The part which Dr. Friel thought was flush was in line with the point of contact with the permanent molars. Undoubtedly the linguo-distal portion of the distal surface of the upper second deciduous molar did project in many cases beyond the lower second deciduous molar, as in the diagram, but this projection did not guide the upper first permanent molar into its normal occlusion with the lower first permanent molar, because the medial surface of the upper first permanent molar sloped distally from buccal to lingual, the slope corresponding to the projection of the upper second deciduous molar. In the diagram, the lines A, B, and C, D, were drawn along the distal surfaces of the second deciduous molars. Where the lines intersect at X, the distal surfaces are flush and this point represents the contact both in the upper and lower arch of the second deciduous molars and first permanent molars.

Mr. H. CHAPMAN said he hoped Dr. Friel had been able to explain the differences between himself and the President. The speaker felt that the apparent antagonism between their views did not in reality exist, as both were careful observers, and the apparent difference must be due to a slight variation in the angle from which they have viewed the problem. He felt much indebted to Mr. Cale Matthews for his paper, on which he would like to ask one or two questions. The first question concerned the chin. Did he rightly gather that these post-normal cases usually had an under-developed chin? His own experience was that one might meet with all kinds of chins in post-normal cases, whether there was apparent protrusion of the upper incisors or not, just as there were different shaped chins in the cases of normal occlusion; and he did not feel convinced that any treatment orthodontists might carry out was likely to affect that. Another point which struck him was, that Mr. Cale Matthews emphasised the fact that the occlusion remained at the same level all the time. The speaker agreed that in the majority of cases that appeared to be so, but he had been puzzled by a few cases in which the deciduous molars in the upper and lower jaw were at a different level to the permanent molars. He would like to know whether Mr. Cale Matthews could explain that condition. It would have been appropriate if Mr. Cale Matthews had given the histories as to the feeding of the individuals whose models appeared on the screen; that would have enabled members to learn something about the effect of natural and unnatural feeding in the production of cases of malocclusion such as had been shown.

Mr. CALE MATTHEWS, in replying to the discussion, said those present would see that he, the speaker, had endeavoured, not in a purely scientific way, to put forward a few thoughts as to obstacles which were not generally considered, either in the causation or treatment of post-normal occlusion. Orthodontists were so liable to regard all their difficulties as being associated within the mouth. He, the speaker, thought there were possibly as many factors outside the mouth which influenced post-normal occlusion as there were within the mouth. He had therefore, put forward some ideas to-night with the object of eliciting the opinions of those present. As to temporary dentition being post-normal, the President had done a great deal of work on that particular type of case, and he thought all would allow they had no idea how common was the condition of post-normality in temporary dentition, simply because they did not have the opportunity of observing temporary dentition in its entirety. It was only, in the majority of cases, when the child was suffering pain, or when the irregularity of the permanent dentition was becoming apparent to parents or guardians, that the dentist had the opportunity of observing these children. If statistics could be gathered concerning the hundreds and thousands of children, from the period of the completion of their temporary dentition, and those cases could be compared, knowledge on the subject would be acquired. But it was only those who had been enthusiastic enough to accumulate sufficient evidence who had any idea how frequent was the occurrence of post-normality in these. He agreed it was more common than could be gathered from practice conducted in the ordinary ways. But that did not alter his thesis at all; that, given a complete deciduous dentition, there was increased activity at the time of the development and eruption of the first permanent molars, and if there was any possible obstacle that could affect the correct cuspal relationship of those molars, it might be a very minute force which could make that into a post-normal occlusion. And if one studied one's cases from the dentition, it would be seen that the margin of safety to correct

occlusion was not so apparent as the reverse ; that it was as easy to develop post-normality in relation to the permanent molars as a normal relation. At any rate, that was his experience in examining these models. He had derived encouragement from Dr. Friel about the vertical distal plane of the temporary molars, and that gentleman had given a very lucid explanation of what the speaker meant and what Dr. Friel meant in the diagram he had drawn on the board. With regard to the position of the mandible, both *in utero* and at birth, on looking at the anatomy books it would be seen that casual inspection gave the impression that the mandible was post-normal, and one could assume legitimately that it might be backward. But his thesis there was that it came into a forward correct relationship by development and by work, and that if this work was not given to it to do, if that needed muscular activity was not generated and was not forthcoming, that that post-normality or that narrow border between post-normal and normal, might go one way or the other. And it was realised that there must be some more or less common factor which was causing this apparent increase in post-normal occlusion. Was it only that orthodontists were now observing more, or was the increase an actual fact? He thought it was the fact, that there were now being seen more post-normal occlusions than were seen as short a time as twenty years ago. Then there was the question of heredity being a factor. The point he wished to make was that if a child inherited a post-normal occlusion, was that any reason why one should not treat it and correct it? Some people would say, "It is hereditary, and whatever you do to it you will not alter it." He did not himself take that view, from his clinical experience. These cases could be corrected, but not easily and successfully if the child were kept under the influence of a parent, in daily association, say, with a mother who was a marked case of post-normal occlusion herself, where the prominence of the upper incisors was so marked that the child would imitate that parent. One might assume, on such experiences as Mr. Marsh gave, that in a period of sickness, at whatever age, there must be an influence on growth, and such extraordinarily exhausting illnesses as a long period of diarrhœa would prove very exhausting to a child. Dr. Friel had also given evidence in that direction. He was very glad that he had at any rate one grain of comfort, in that Dr. Friel agreed with him as to this temporary dentition ; though Dr. Friel rather spoiled it by saying that all the slides the speaker showed were of post-normal cases. Dr. Friel had put it in another way : at what age and at what time in the temporary dentition should the dentist take them as normal? If he said that at 5 years, on the average, there should be a change, Dr. Friel's and his own thesis broke down. If it were taken at the completion of dentition, that was talking about another subject. If there were a brick wall, perfectly vertical, and there were leaning against that brick wall two bodies which could move with equal force and equal speed, and one portion of that wall was blown down and allowed one of those bodies which were pressing against it to move forward rapidly, that constituted an illustration of what might happen when temporary teeth were lost or when the point of contact might be disengaged. It was difficult for him to express more than he had tried to do by those slides ; but if members would think over quietly what he had said, he thought they would gather what had been his meaning. Mr. Chapman asked him about the undeveloped chin, and whether that was constant. The undeveloped chin was unquestionably one of the conditions which were seen after a post-normal occlusion. What was meant when the term "undeveloped chin" was used? Did one mean its prominence? Or its vertical growth? But the chin would not be fully developed, either in its prominence or in its depth, and members must be familiar with many cases of post-normality in which the mandible was nearly chinless. But that gentleman said it was not possible to produce a chin. He, the speaker, had seen many instances in which a chin had developed marvellously after treatment. With regard to depression of temporary teeth and the occlusal plane being constant, Mr. Norman Bennett, before this Society a few years ago, showed some cases, or the matter came up in discussion—he forgot which—in which the temporary teeth were below the occlusal plane after the eruption of the first permanent molars. Was that not that rather the over-development of the first permanent molars and the squashing down of the temporary teeth, or the constancy of their remaining in their original plane? From time to time slides had been exhibited showing how these things could occur. The whole point of this post-normal occlusion he thought was that the profession was somewhat in the dark, because a large measure of success was secured up to a point, and it must be within the knowledge of anyone present who was seriously practising orthodontics that they could get perfect unilateral success, a perfect occlusion, on one side, and they could get a perfect occlusion, as far as molars were concerned, on the other side, and it might not revert. But

had not all members had cases in which they had had, on one side, premolars with a point-to-point contact? No amount of attention and no amount of appliance wearing would finally correct those cases. He wanted to know what was the cause of that type. What he meant by a pseudo-post-normal case was a case of the kind he had hoped to project on the screen. Although the occlusion might be post-normal, was one justified in calling it a definitely post-normal case if it came into correct occlusion without any actual force being applied to the mandible movement? If he released an anterior obstruction due to, for instance, misplaced incisors, immediately those teeth were placed in correct occlusion, the mandible came forward automatically and naturally.

A REPORT ON SOME TYPICAL CASES OF MALOCCLUSION WITH METHODS OF TREATMENT.*

By H. C. Visick, L.D.S.

Although I have nothing new or original to give you, I thought it might initiate a helpful discussion if I showed you slides of some of my cases before and after treatment, and described the methods used.

When I started to treat orthodontic cases many years ago, we used vulcanite plates almost entirely. Then came a period when we used all-metal Jackson Crib Plates.

After being at Dr. Angle's school in 1906, I used Dr. Angle's appliances for some years, more particularly for the intermaxillary traction in Class II cases. Orthodontics, in those days, was a very trying job, as the German silver bands were continually breaking, the tubes getting bent and the ligatures coming off the teeth. This, coupled with the discoloration of the metal and inflammation of the gums was very depressing, and I practically gave up attempting to correct Class II cases without extraction. For the next twelve years, I confined myself largely to the use of removable appliances, consisting of vulcanite plates held in by gold cribs, with gold spring wires to move the teeth. I still used fixed appliances principally for retention and for rotating teeth.

For the last five years, I have been largely using the lingual arch and precious metal appliances under what is known as the Mershon Technique, and my experience is that it easily surpasses the older methods. Strength, reliability and cleanliness are great points in its favour. The materials are so tough and strong that the bands never break, and as there are no ligatures, that constant source of trouble is eliminated. In this system the teeth are not subjected to violent or jerky pressures. The essence of the treatment is slow and sure movement. My experience with these appliances has been so satisfactory that the last few years I have been tempted to again undertake the treatment of Class II cases without extraction. Time will prove whether these cases will remain corrected, but there are grounds for hoping that the results will be permanent. The earlier we can correct an irregularity, the greater the chance of permanence, and these delightfully neat appliances can be put into the mouths of quite young patients.

Another point is that we can continue the treatment for a much longer time, the appliances being so small and clean, and giving so little trouble to the patient and the dentist.

With Class II cases in the old days, we used to divide our treatment into active treatment and retention, and I expect some of you can remember the great difficulty we had with inclined planes fixed to molar bands which used to break every few weeks. Nowadays, the tendency is to combine active treatment and retention in the one appliance.

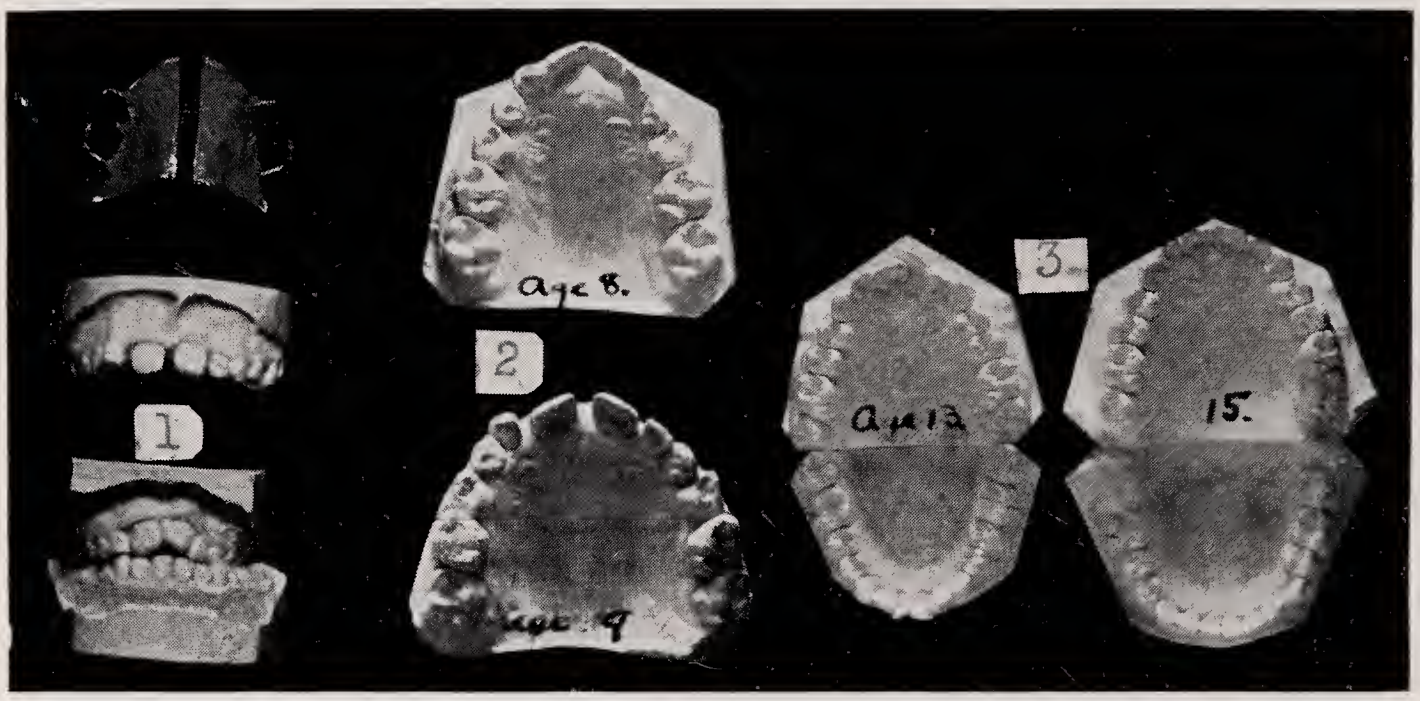
I will now show you some slides.

* *Transactions* of British Society for the Study of Orthodontics.

Class I.

Case No. 1 (Figs. 1 and 2) was a boy aged 9, with a very narrow upper arch which was associated with a completely blocked nose. I put in two Badcock expansion plates in succession, and in nine months his arch had expanded as you see on the second model. In this case I separated the two halves of the maxilla; on applying pressure to the outside of the upper molars, one could see the centrals moving. I still use Badcock expansion plates in all cases needing expansion. I think they are quite the most simple means of obtaining a definite expansion all over the arch. Having obtained the necessary width with one of these plates, I then put on a lingual arch which is an excellent retainer.

Case No. 2 (Fig. 3). This is the type of case which was treated much too late. The arch was very considerably enlarged all round, and the teeth are in fair position. But I feel sure we should be disappointed with the final result in, say, ten years' time.

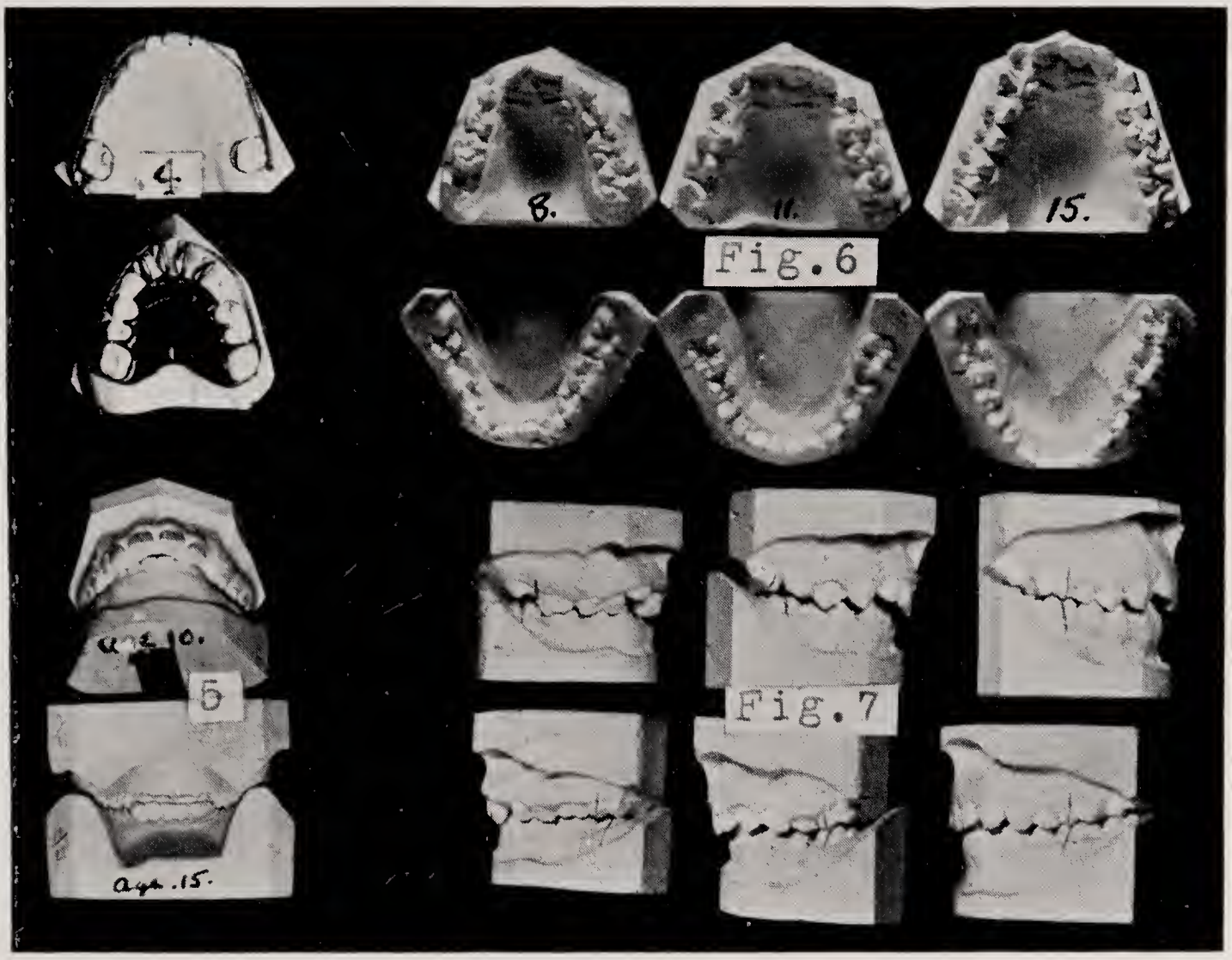


Treatment of Class II Cases (Figs. 4, 5, 6, 7).

I know some people say that if we expand the upper jaw, the lower jaw will sometimes jump forward into normal occlusion. All I can say is, that I have never seen the slightest tendency for a Class II case to correct itself. My experience is all the other way, and I sometimes wonder if I have ever obtained a perfect and permanent result in a Class II case when I have attempted to bring the lower jaw forward.

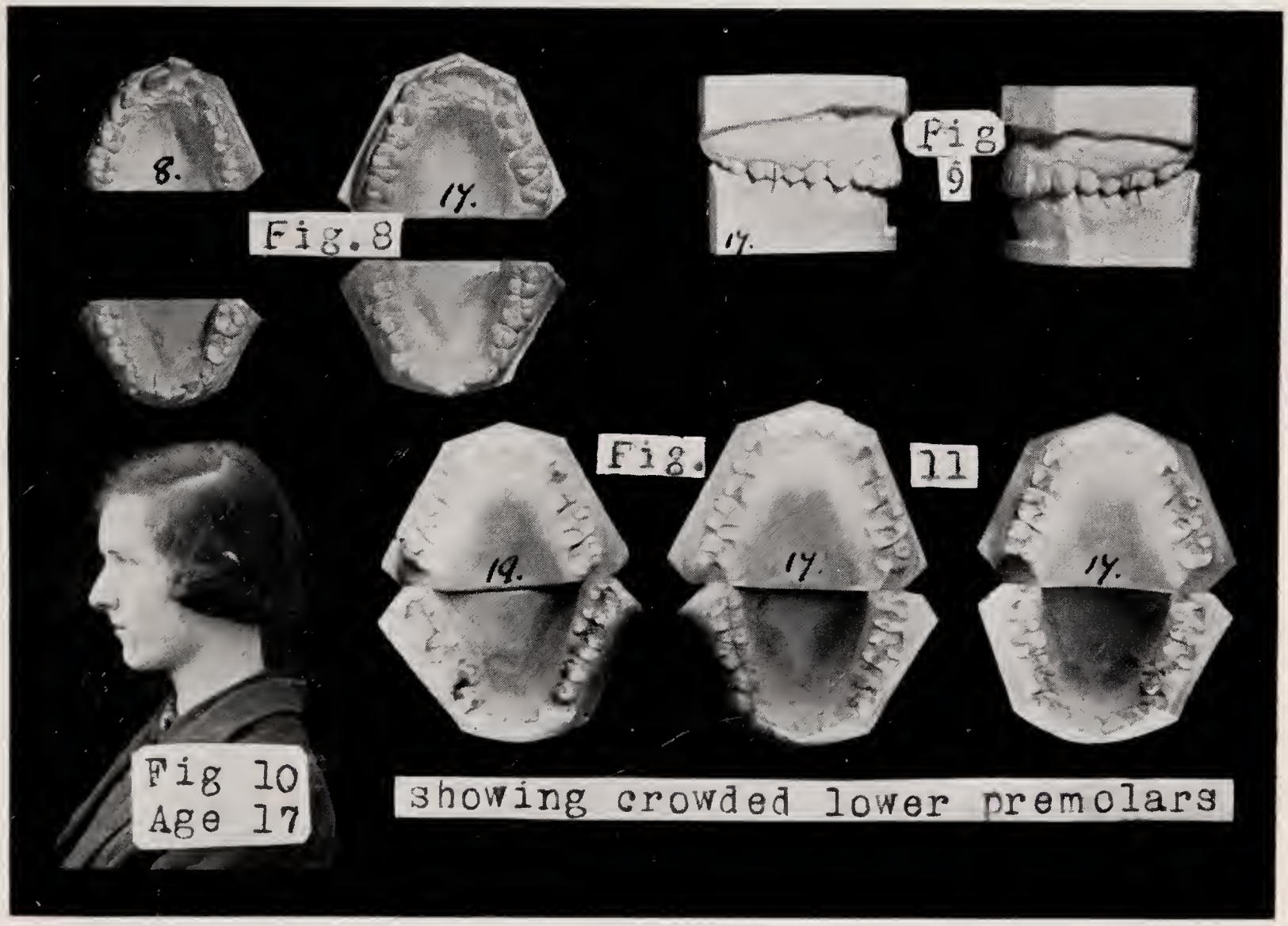
If there is an excessive over-bite, I generally put in a vulcanite bite-plate with spurs on the incisor teeth. This is worn for six months or a year. At the end of that time, it will be found that the over-bite has largely disappeared, and then one can go ahead with fixed appliances and intermaxillary traction. In cases where we have had to extract the first upper premolars, the canines and incisors should be slowly retracted during the period when we are correcting the over-bite.

If the patient is older than about ten years of age, I should prefer to do the retraction of the upper teeth with a fixed appliance so as to prevent the back teeth tipping forward. This is most important. It is a very easy matter to ruin the bite entirely, by attempting to pull back stubborn teeth. It is not only age which determines whether we should use a fixed appliance or not. Cases vary enormously in their resistance to tooth movement, and as far as I know there is no means of



determining beforehand which case is going to prove difficult, and which easy.

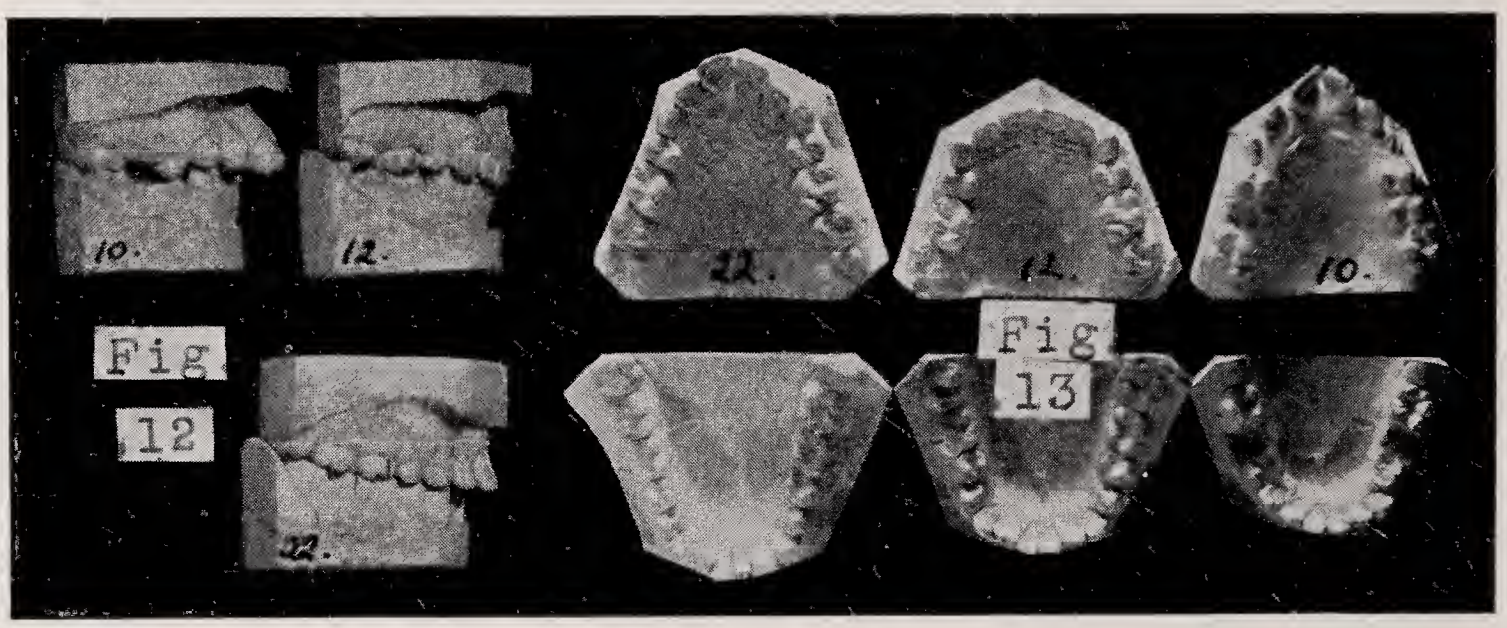
Case 3 and 4 (Figs. 8, 9, 10, 11) are Class II cases, treated some years



ago (without extraction) by general expansion, and then intermaxillary traction. The results are far from ideal, and I quite expect that in another ten years, when the wisdom teeth have erupted, the condition will be much more disappointing still. I want you to notice how often the lower premolars become wedged together and crowded out of the arch. This usually begins to show itself about 17 years of age, although I have frequently watched it getting worse and worse up till the age of 25.

Mr. VISICK interrupted the reading of his paper to remark that on one occasion in his earlier career, he received a letter from a dentist asking him if he would extract for him from a child the four first premolars. He was very indignant at such a request, and sent a note back, which he hoped was polite, saying that his conscience would not allow him to extract four premolars in a boy. The work was done by someone else, and not long ago, he saw the patient, now a grown man, and the result was quite a passable one, as far as the teeth were concerned, though the appearance of the jaws was rather puny for so big a man. To-day, if anyone asked him to take out the four premolars, he thought he would still make the same reply; nevertheless, he had seen so many dreadful cases of impacted lower wisdom teeth, that he might possibly, in time to come, shift his ground.

Cases 5, 6, 7, 8, *and* 9 are Class II cases treated by extraction. The first one (Figs. 12 and 13) I used to be very proud of, and for many years used it to demonstrate to sceptical parents what I could do. When I was asked to read this paper, I thought I would make an effort to get into touch with this patient, who had left school ten years before. His dentist took impressions for me. The result was a great shock, as you can imagine! The fault in this case was, I think, that treatment was started much too late, and retention was too short.



After-treatment photographs of the patients' profiles in Cases 7, 8 and 9 are interesting in view of the fact that I have extracted the first upper premolars.

Case No. 10 (Fig. 18). This is a case treated without extraction, and with the modern appliances, at nine years of age, and I see not the slightest sign of the teeth returning to the old positions, although the elastics have not been worn for ten months now.

CLASS III.

Class III cases are the most hideous cases when they have developed, and the patient is handicapped for life with an ugly jaw and a most

15.
15.
Fig
14a
18
12.
Ag 12
12
15.
12.
Fig
14b
10
12
19.
Fig.15a
Fig.15b
16a
10.
15.
16b
9.
17a
18.
10
13
16c
9.
18.
Fig.17b

awkward bite, but if tackled early they are easy to treat and there is no relapse.

There is one aspect of Class III cases in which I believe they differ from every other class, and that is, in the way they sometimes progress. They can start with a single upper incisor getting behind the lower teeth. Or a lower temporary incisor, about to be lost, tips forward and catches on an upper incisor, and the patient feels it is more comfortable to bite with the lower teeth forward. Once this position is established,

the other teeth drop automatically into the wrong position one by one as they erupt. It is rather like a game of skittles, when you knock over one and that knocks over the next one, and so the downfall extends to the whole lot.

This explanation will not cover all cases of Class III, but from what I have seen, I believe it holds good in many cases, so it is easy to see that a very little treatment will correct the first two or three teeth, or in the case of temporary teeth being wrong, if we watch for the eruption of the permanent teeth and guide the first two into correct positions, the rest will follow.

A very satisfactory point about Class III cases is that they are the only ones which are really retained by correct occlusion. We have often been told that to obtain retention, all that is necessary is to establish correct occlusion, and the interlocking of the cusps would do the rest. Alas! scores of failures have proved this pleasing theory to be unsound. On the contrary it is strange how little influence the inclined planes of one jaw exert on the inclined planes of the other.

Occasionally, in the case of narrow upper and lower arches, I have managed to expand the lower and carry the upper with it. But this can only be done in certain deeply interlocked cases if the expansion of the lower is very gradual indeed.

The next three cases are all Class III.

Case No. 11 (Fig. 19). A girl of 13 had two abscessed lower first molars which I extracted and most of the correction was done by pulling back the lower front teeth. I saw this patient ten years later, and the teeth were still in the same position, but she told me that she often had to put in the lower retaining appliance to prevent the teeth coming forward.

Case No. 12. This was the youngest patient for whom I have ever

attempted treatment. He was eighteen months old when his mother brought him to me with all the lower teeth locked well in front of the uppers; in fact, when he shut his mouth, the upper teeth disappeared from view. I used an Angle's chin-and-head cap with elastics with considerable trepidation, wondering what the effect on his skull might be. I was pleasantly surprised at the rapidity with which the lower jaw was pushed back, and at the end of six or eight weeks we

Fig. 19

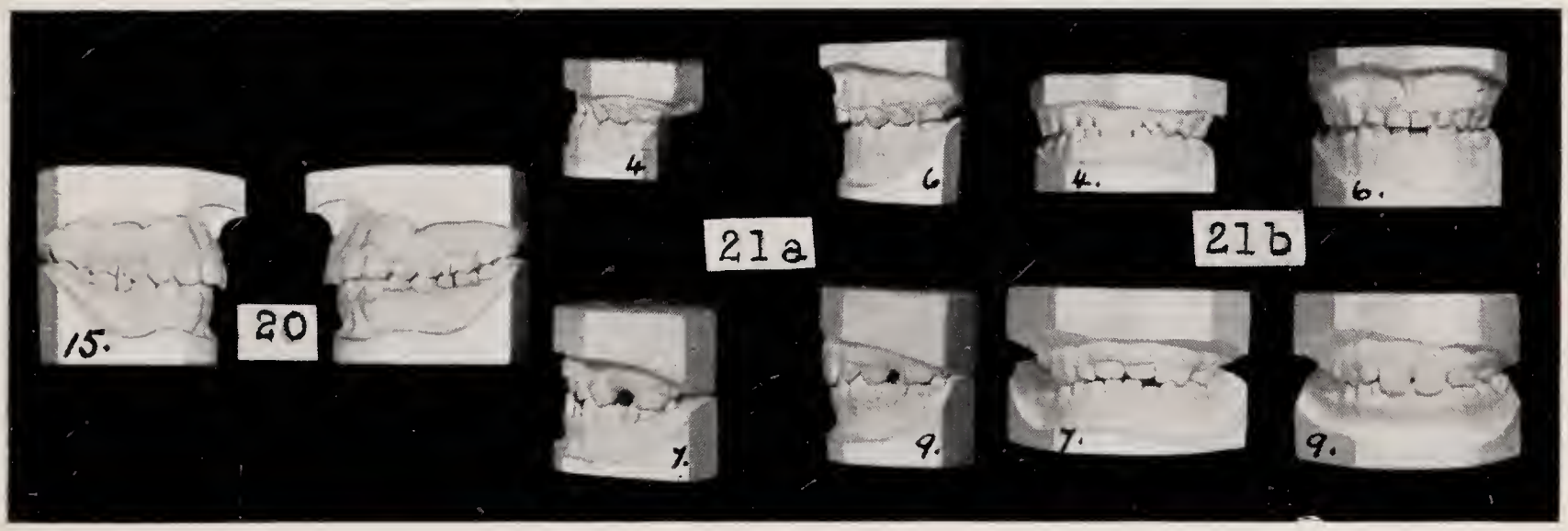
were able to discontinue the use of this apparatus, and the result twelve years later you will see in the next model. This boy's sister, age 7, is showing signs of becoming a Class III case in her second dentition, the upper centrals have got behind the lower laterals.

Case 13. Treatment in this case was started at $4\frac{1}{2}$ years of age. Her paternal grandmother, 70 years of age, is also a Class III case. I have no doubt myself, that this child has inherited the condition. What mysterious force is it that can so persistently, after such a long period, produce this irregularity ?

I began by pushing out the temporary upper incisors and canines with spring wires on a vulcanite plate. When the permanent upper incisors erupted, they also showed an inclination to erupt behind the lower incisors, and I then used a fixed appliance with finger-springs to press the teeth forward. At the present time all is going well.

To sum up my observations on these cases.

Class I cases with crowded incisors call for very lengthy retention; 3 or 4 years will not be too long, and even then, they will always show signs of relapse, especially if treated without extraction.



Class II. (*A*).—Treated by expansion and intermaxillary traction. Relapses certain unless treated early, not later than 9 years of age.

(*B*).—Treated by extraction of upper 1st premolars. Pleasing result certain, and no relapse if treated early. Crowding of lower teeth very frequently occurs when 3rd molars erupt.

Class III. No relapse, if treated early.

As this is an Anniversary Year of the foundation of our Society, I am tempted to make some general remarks reviewing the results of my study of Orthodontics.

When I was being initiated into Orthodontics at Guy's Hospital thirty years ago, much was made of Etiology, and we were told that it was absolutely necessary, before we treated a case, to find out the cause of the irregularity. I must confess to you that to-day, in the majority of cases, I make no pretence of discovering the cause.

It may be an admission of indolence, but I am tempted to ascribe many irregularities to heredity. With what pertinacity some teeth insist on erupting badly! Incisors and premolars persist in rotating as though under some malign influence; teeth do not fully erupt; upper molars erupt lingually; Class III cases appear generation after generation. Inheritance seems the only explanation.

Treatment.

In Eastbourne there are many schools where children come from all over the country, and indeed much further afield.

This is helpful, as we see every variety of Orthodontic appliance—some beautiful, others fearful and wonderful!

Plates with inclined planes to "jump the bite" are a failure in every case I have seen. Perhaps I have been unfortunate.

Orthodontic plates made completely of vulcanite which cover the back teeth, are a source of rampant caries. I remember one case where a molar and premolar on one side had completely crumbled away, nothing was left but the roots, which had to be extracted. Such plates are quite unjustifiable, but we still see quite a number of them.

The use of wooden pegs is happily dying out, but we still get a few to annoy us. A piece of gold wire used instead can be adjusted in a moment and is much simpler.

Orthodontic cases ought to be seen at frequent and regular intervals. In the case of boys, I think a weekly visit is not too often. Although we may not have to do anything to the appliance, it is essential that the patient should be kept up to the mark in cleanliness, and again, if something goes wrong with the appliance, it is at once put right. Girls are much more reliable in the carrying out of instructions than boys. My practice has been to find out which is the most convenient hour and day for the school to send the child down, and then to book that time ahead every week throughout the term. This has worked very satisfactorily, as forgotten or mistaken appointments are rare.

My paper is largely a confession of ignorance and failure, but of all the branches of dentistry, I still find the Study of Orthodontics the most difficult, the most tantalising, and the most fascinating.

Discussion.

The President, Mr. G. Northcroft, said that the audience had listened to a very interesting exposition of Mr. Visick's triumphs and failures. It was extremely good to have a man so courageous that he would place on the screen cases which might be described as a little unfortunate in the way they had turned out. All those present, however, were well acquainted with failures in orthodontics. Among the mass of material which the author had brought forward there were one or two things on which he himself would like to make a comment. On one point he desired to warn Mr. Visick: he noticed that in one of his Class II cases, the intermaxillary hooks on the lower sixes were put on the distal corners of the sixes, which in his own hands had proved to be a dangerous practice. He now placed the hooks on the medial corners of the sixes invariably. In this way one did not get that undue pressure from a lingual arch on lower incisors, and the result was more satisfactory.

Mr. Visick had spoken against the results of forward vulcanite biting plates, and said he had never seen a success. The speaker had had three cases which he knew had been absolute successes, one which he finished in a girl of twelve; she was now eighteen, and her bite was perfect. He did not say this because she happened to be his patient, but because a perfect result did happen occasionally.

Mr. Visick had raised the point that orthodontic treatment produced impacted mandibular third molars. The speaker thought this was an absolute mistake. The impacted mandibular third molar was developmental and had nothing whatever to do with orthodontics. It might be brought to the dentist's notice more because perhaps orthodontists X-rayed their cases more than other people. But all these things, he was sure, were developmental in origin. In the same way a rotated incisor was due to the fact that it was rotated in its crypt to start with.

He was interested to hear that Mr. Visick had come to the conclusion that a vast number of these cases were due to inheritance in some form. But one had to be careful, as he had said on a previous occasion, not to confuse cross-breeding or the mixing of racial characteristics with the inheritance from father to son of a peculiarity. It did not explain the thing to call an irregularity inherited simply because a grandfather happened to have had it. He was quite convinced that many of these irregularities were inherited and that many of them arose from cross-breeding.

Mr. Maxwell Stephens, after congratulating the author on a very interesting paper, said that Mr. Visick in attending so many school boys, was fortunate in having seen the work of a number of men scattered over a wide area, and he had taken what might be described as a wide-angled view of orthodontic work. The speaker thought that the æsthetic sense was sometimes a great trial to the possessor. With regard to the first upper premolars, their early extraction often made a very noticeable difference to the face : in the case of a big man such as Mr. Visick described, the result was to give a smallness to the face which did not accord with his general stature. Then there was a point with regard to the expansion plates. Mr. Warwick James always cut out the vulcanite at the back of the screw, and the parallel bar, as it enabled the cleansing of the plate to be carried out more easily, and he (the speaker) found on following this procedure that it did not interfere with the holding up of the plate at all, and it made a very sound appliance of it. With regard to the Badcock plate, it should be cut down to the cervical margin and not left on the inclined planes of the lingual surfaces of the teeth, otherwise there would be displacement as the plate was opened. In a good many cases appliances had been used without any extractions whatever being performed. We had a good many records of cases started at the moderate age of eight, nine and ten, when histories could be substantiated, but as yet we had still to wait for records.

Finally, in considering the treatment of Class III cases which the author maintained were easy to treat: there was a type he had met with which was by no means easy, and might be impossible to treat by the usual methods. He therefore claimed that certain types must be differentiated and their etiology accounted before satisfactory treatment could be pursued.

Mr. H. G. Watkin said they would all agree with the author that per-

manency of results was the desired object. One point not sufficiently borne in mind was the size of the tongue. In a number of the cases which the author had shown one of the premolars had moved lingually. If the tongue were sufficiently big probably the teeth would remain as they were placed, but these abnormalities occurred where there was more pressure outside from the teeth than inside from the tongue, and, therefore, the jaw did not remain extended. When he saw the over-bite so reduced by angles or arches, he thought some of that over-bite reduction was probably brought about by the elongation of the molars. The author had stated that the Class III cases were handicapped for life. The present speaker did not agree with that ; he thought there was a way out, and at the next meeting of the Society he was hoping to read a paper on that subject.

Mrs. ROBERT LINDSAY, speaking with regard to the Class III cases, wondered whether Mr. Visick had seen the X-ray photographs of the temporary dentition by Drs. Bustin and Leist in Germany. These investigators were engaged in a series of studies, and curiously enough the cases they met with nearly all belonged to Class III. They divided the cases into "symptomatic" and "genuine," and showed in their pictures that where there was a gap between the latest erupted tooth and the germ of the developing tooth in the jaw there was a favourable prognosis, and those cases could be treated, because of the possibility of utilising this space ; but where there was no space between the latest erupted tooth and the tooth germ in the jaw there was the prospect of trouble for the orthodontist. These workers suggested that all these cases as well as the cases in Class II, should have X-ray photographs taken systematically. The pictures they produced were very interesting and worthy of the study of all orthodontists. They showed movements of the tooth germs in the jaw actually underneath the temporary teeth. Mr. Visick had said that some of his cases were heartbreaking ; she had wondered whether X-ray photographs were taken in these cases to see whether this space between the tooth and the developing germ existed in these cases, thus giving a more certain indication of the results of treatment.

Mr. ROBERT LINDSAY said that he did not desire to intervene in matters involving treatment, but like all the members he was interested in what Mr. Visick had shown. One point arose on the first slide ; this was a case in which there was separation of the maxillary suture. He noticed in the last of the models that there was a distinct space between the two front teeth. This presumably was due to the fact that there had been a deposit of bone in the suture, and raised an interesting question if Mr. Visick proceeded to close these two teeth together. Either the two teeth would be approximated by moving them through the bone, or the pressure would result in the absorption of the bone in the suture and possibly the reproduction of the narrow maxilla with which he started. It would be interesting to learn what actually happened after treatment.

He noticed with some astonishment that nothing had been said about systematic X-ray photographs being taken in these cases. He would suggest that the X-ray evidence should be obtained in every case, not merely in those particular matters to which Mrs. Lindsay had just drawn attention, but that wherever possible X-rays of the temporo-mandibular joint should be taken as they might explain a good deal both with regard to cases in Class II and Class III. In the early stages the temporo-mandibular articulation was a very loose affair, and judicious manipulation apart from movement of the teeth might improve the case materially.

With regard to the lapsing of cases, he noticed that all the pictures shown were of the buccal aspect of the articulation ; in no instance was the lingual aspect shown. With a perfect appearance of normal occlusion on the buccal side, there might be a different condition of the lingual cusps, and this had been held to account for lapsing. In certain cases of English people the lapse might be due to a reversion to type. Continental caricaturists were always calling attention to the fact that there was a pointed variety of mouth among English people, and those cases which Mr. Visick had treated and which had reverted again might be simply reversion to the type to which that particular person belonged.

Mr. H. CHAPMAN said that he had found the author's retrospect of the situation during the last twenty years most delightful. On one point Mr. Visick

had asked for advice. It was easy to give advice when one had not to carry out the treatment, but if the case were his own he would certainly take out four teeth, in the lower jaw two premolars, and in the upper jaw, on the left side, he would probably remove the lateral because it was rotated, and on the right side he would probably take out a premolar. The Society would remember that some time ago he himself showed a case in which he removed a lateral in a somewhat similar position, and instead of the canine coming into the place of the lateral, the first premolar moved so far forward that the canine could not get in. Therefore he would suggest that something should be put in to keep the space until the canine erupted.

He was not quite clear whether Mr. Visick had made up his mind that the removal of two premolars in his last two cases was preferable to keeping all the teeth. He seemed to have got some excellent results by the removal of premolars. Had he arrived at a definite decision on that point? The speaker himself had not succeeded in treating cases such as Mr. Visick had shown without intermaxillary retraction. It might be that he was referring to a different type of case, but he had arrived at the opinion that to get a successful result in Class II cases constant intermaxillary traction was essential. He mentioned this because some patients seemed to be negligent in keeping their rubber bands on all the time. If there was a wobbling of the mandible backwards and forwards, he was inclined to think that impaired the prognosis. He was surprised to hear Mr. Visick say that he used a Badcock plate to get the lateral expansion, and then afterwards put in a lingual arch. It seemed to him that he might just as well have put in the lingual arch at the beginning.

He had been interested especially in his Class III cases in which the chin-strap and headpiece had been used. He had heard of that being done, but had never seen a case. One question which he would like to ask Mr. Visick was whether he still removed the lower incisor in certain of these cases. It seemed to be the general experience that a lower incisor very often did not effect any improvement.

Mr. CUTLER had been interested in the description of Class III cases and noticed the author's stress on the hereditary factors. It was often said that enlarged tonsils might be a local factor, and the speaker had seen three cases in children which bore this out. The last of the three was a child of seven, whose lower teeth were biting right outside his uppers. His parents had a normal Class I articulation. He asked them whether there was any history of tonsillar trouble, and was told that the child was then under treatment for enlarged tonsils, but that the removal of them had been deferred on account of the child's bronchial condition. Would the author consider the removal of the first premolars and retraction of the six lower front teeth to be good procedure in a patient aged about twelve years?

Mr. H. C. HIGHTON said that he was beginning to wonder whether it would be advisable to extract the lower incisor in a perfectly normal Class II case. In one such case he had had practically a perfect result seven years after the operation. The bite was perfect.

The President, Mr. NORTHCROFT, in closing the discussion, pointed out to Mr. Lindsay that radiographs of the mandibular joint were extremely difficult to obtain and very unsatisfactory when obtained, being practically impossible to read. He doubted whether it would be very much good to attempt such a thing as Mr. Lindsay had suggested. He himself had often endeavoured to get it done, but he had never obtained any satisfactory results. In 1914, at the International Dental Congress he showed a case where he thought he had separated the two maxillæ, but he was severely criticised by one authority there who said that this was impossible, and showed slides to illustrate the impossibility.

Mr. Lindsay had raised another point upon which Dr. Friel also laid great stress, namely, the number of cases of Class II in which there was rotation of the molars. It was the occlusion of the anterior lingual cusp of the molar which was far more important than the occlusion of the buccal cusps. When members had got very nice results from the buccal aspect they should pay some regard to the lingual aspect also. He appreciated Mr. Highton's reference to the incisors. A case sent to him had been treated with intermaxillary traction and showed exactly the same thing as Mr. Highton had mentioned.

Mr. VISICK, in replying on the discussion, took up the President's point with

regard to bite plates. All he could say was that he, personally, had not seen a Class II case successfully treated by bite plates, and he did not think it would be a very good way of treating these cases. He would use intermaxillary traction and have done with it.

As to the impacted third molars, he had not really meant to say that orthodontic treatment *caused* the impaction, but if a tooth were extracted the impaction was not so likely to occur, or if it occurred it would not be so grave. He was of opinion that if, by keeping all the teeth, the orthodontist thought there might be impacted wisdom teeth he ought to extract something. He had seen patients suffering much from impacted wisdom teeth.

In reply to Mr. Maxwell Stephens, he did not pretend to have shown anything new. He had simply been in a position to see a large number of cases, and if anything new came along which appeared likely to be useful he had made a note of it. With regard to expansion plates with the vulcanite cut away from the screw, he had always looked upon them as workmanlike, but he had not followed the practice himself.

As to the suggestion that Class III cases should be divided into different sections he quite agreed. Class III cases as a rule had something wrong with the lower jaw. In the case of Class II, it was partly the upper and partly the lower, but in Class III it had often simply to do with the lower jaw slipping forward. Once this process had started it was going to become progressively worse.

Mr. Watkin had mentioned the size of the tongue. The difficulty he had found was to decide whether the tongue was large or small. He had made patients put out their tongues, and some of them had got very large tongues with a narrow arch. He could see that there ought to be a big influence exerted by the tongue upon the teeth.

As to the over-bite corrected by the eruption of the molars, he did not pretend to say how the over-bite was corrected. It seemed probable that it was a combination of several things, the molars themselves erupting, the lower incisors being pressed into their sockets, and general growth all round.

He had not read the studies of the German dentists to which Mrs. Lindsay had referred. He was sure that they were very interesting. He was of opinion that Class III cases often started by a slight discomfort in the front of the mouth. A lower incisor got loose, the child brought the jaw forward to avoid contact with the upper teeth, and a Class III case was the result.

Concerning the examination of the mandibular joint with X-rays. He had occasionally by accident got a good result, but when he really wanted a picture of the condyle, he had never got a good one, at least with his ordinary dental X-ray apparatus.

The interesting question had been raised as to whether it was possible to alter racial type. If a boy came in with protruding incisors he would have a shot at it, any way.

He had been interested to hear Mr. Chapman's advice on the subject of extracting the four premolars. He himself had been wavering on that subject, and wondering what he should do in the future. He had never had the pluck to take out an upper lateral except in one case where the unerupted canine had eaten away the root of the lateral. He must say that he would rather shrink from taking out a lateral. He had seen one case in which two centrals were taken out—not by himself—there were records of this in the Proceedings of the Society—it must have been about twenty years ago. The result was quite wonderful, the space was absolutely closed up, the two laterals came together, and the result was quite a pleasing one. A question was asked as to whether the upper premolars should be taken out in a Class II case. He thought the chances of a permanent result were much greater than if the lower jaw were pulled forward. With regard to the question of retention, he did not use a fixed appliance for retention, but always a removable appliance, to be worn night and day for the first three or six months, and after that for the night only.

The question of treating a Class II case by extraction depended upon the case itself. He thought it was doubtful whether a permanent result would be obtained by intermaxillary traction in cases treated later than 10 years of age. Mr. Chapman had asked why he did not use the lingual arch for expansion straight away. He had not had good results by that procedure, but with a Badcock plate he knew what he could do.

Mr. Cutler had spoken about Class III cases and heredity, and had asked whether he would extract the lower first premolars in a Class III case in a child of twelve. He thought that was the only possible treatment. A good result would not be forthcoming even then, because the chin itself was too far forward.

Mr. Highton's remarks about the lower incisors were very interesting. He had taken out an incisor and had got the teeth all right for the time being, and two or three years later they were crowded again, so that he had taken out another incisor. He had done this very rarely, and he was driven to the opinion that the taking out of an incisor was not of much use. The best thing was to expand, and he was hoping that with the wonderful new appliances now available the procedure would be simplified. He wished to thank the members for the sympathetic reception given to his paper.

The PRESIDENT expressed the thanks of the Society to Mr. Visick, and the meeting terminated.

THE Annual General Meeting of the Society was held at 11, Chandos Street, Cavendish Square, W.1, on Monday, December 2nd, 1929, the President, Mr. G. NORTHCROFT, occupying the chair.

The HON. SECRETARY read the minutes of the previous meeting, which were confirmed and signed.

OFFICERS AND COUNCILLORS FOR SESSION 1929.

President, Mr. H. E. Marsh; Immediate Past President, Mr. G. Northcroft; Vice-Presidents, Mr. A. T. Pitts, Mr. Bertram Samuel, Mr. H. G. Watkin; Secretary, Mr. A. L. Packham; Treasurer, Mr. W. Ovey; Curator, Mr. L. F. Fouraker; Librarian, Mr. H. R. Evans; Editor, Mrs. R. Lindsay; Councillors, Mr. Carl Schelling, Mr. F. St. J. Steadman, Mr. H. C. Visick.

AUDITORS.

Messrs. Garrow and Phillpots were proposed and seconded as Auditors for the ensuing year, and were duly elected.

HON. TREASURER'S REPORT.

The HON. TREASURER read the following report :—

During the past year the Society's income has been £233 9*s.* 3*d.*, chiefly from members' subscriptions, and a donation to defray the cost of the Presidential Badge has been received from its first wearer, Mr. Maxwell Stephens.

The expenditure has been £279 16*s.* 3*d.*, of which £139 16*s.* 3*d.* represents the expenses of conducting meetings; £80 has been allocated to the Prize Fund, and £65 to the Reserve Fund, bringing this latter up to £100, which sum, together with a like amount which it is hoped to set aside next year, the Council propose with the consent of this meeting to earmark as this Society's contribution to the funds of the International Orthodontic Congress.

This leaves a deficit on the year's working of £31 14*s.* 6*d.*

The Society's assets are (Prize Fund) 500 National Savings Certificates at a present value of £440. Cash on deposit, £100 (I.D.C.); cash at bank and in hand, £10 18*s.* 9*d.*; making a total of £550 18*s.* 9*d.*, as against £420 3*s.* 3*d.* last year.

A MEMBER asked whether it was assumed that for the next year there would be a profit of £100 to be allocated to the Prize Fund.

The PRESIDENT replied that there was never a profit, but somehow the Society always had a good balance. He left the Treasurer to his own methods of juggling. He did not know how it was done, but he had no doubt that the sum to be allocated to the Prize Fund would be safely arranged.

On the motion of Mr. Steadman, seconded by Mr. Evans, the Hon. Treasurer's report was unanimously adopted.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

INCOME AND EXPENDITURE ACCOUNT, December 1st to November 30th, 1929.

Income.

1927-1928. £ s. d.		1928-1929. £ s. d.
215 5 0	To Members' Subscriptions	228 7 6
	,, Sale of *Transactions*	1 17 10
0 15 7	,, Deposit Interest	1 1 11
	,, Various Credits	2 2 0
	,, Donation Presidential Badge ..	14 12 6
42 10 8	,, Dr. Balance	31 14 6
£258 11 3		£279 16 3

Expenditure.

1927-1928. £ s. d.		1928-1929. £ s. d.
25 0 0	By Rent	25 0 0
28 9 6	,, Printing	30 2 8
27 10 6	,, Printing *Transactions*	41 10 3
18 18 0	,, Reporting	18 18 0
2 2 0	,, Refunded Subscription	1 1 0
1 12 6	,, Library Account	1 11 6
10 6 0	,, Museum Account	
14 12 6	,, President's Badge	
1 0 0	,, Loan of Chair..	
33 13 0	,, Honoraria	
10 10 0	,, Refreshments	10 10 0
	,, Petty Cash	5 17 10
0 12 6	,, Bank Debits	0 5 0
178 11 3		134 16 3
80 0 0	,, Transfer to Prize Fund	80 0 0
	,, Transfer to Reserve Fund	65 0 0
£258 11 3		£279 16 3

We have examined the Books and Vouchers and find the above Statement of Accounts to be corect.

November 30th, 1929.

WALTER GREEN,
NORMAN GRAY, } *Hon. Auditors.*

BALANCE SHEET.

	Dr.			*Cr.*		
	£	*s.*	*d.*	£	*s.*	*d.*
Per 400 National Savings Certificates	392	10	0	360	0	0
Increment on ditto	17	10	0			
100 National Savings Certificates				80	0	0
Per Deposit Account	35	0	0	100	0	0
Income and Expenditure Account	145	0	0			
Cash at Bank	37	17	3	6	0	7
Cash in Hand	4	16	0	4	18	2
Dr. Balance				31	14	6
	£582	13	3	£582	13	3

Hon. Curator's Report.

The President announced that the Curator was unfortunately absent, and therefore was unable to read his report personally.

During the year just closed no great activity can be reported as far as the Museum is concerned. We have received a gift of casts from Mr. Watkins, which has been suitably acknowledged with thanks. The cabinets and their contents are still housed most generously by Mr. Highton, to whom the thanks of the Society are due, but under the circumstances it will be understood that although efforts have been made and time spent in classifying and mounting specimens, the permanent housing of the museum is a matter demanding the immediate attention of the Council.

Hon. Librarian's Report.

Mr. H. R. Evans, Hon. Librarian, read the following report :—

There is very little of importance to report in connection with the Library. No new volumes of outstanding importance have been received or purchased during the current year. In this connection the Librarian begs to remind members that the Council would welcome any suggestions with regard to the acquisition of any new books.

The Library regulations allow of facilities for the lending of books, but it would appear, that this fact is not fully appreciated, as the amount of borrowing by members has been surprisingly small, considering the number of valuable books at their disposal.

In one or two instances, copies of old *Transactions* have been presented to members in order that they might complete their sets.

The Librarian is only too anxious to accommodate members if they will communicate with him.

On the motion of Mr. Highton, seconded by Mr. Watkins, the report was unanimously adopted.

Hon. Secretary's Report.

The Hon. Secretary read the following report :—

The year just concluded is memorable as the 21st birthday year of the Society. To mark the occasion, Mr. George Northcroft, from whom originated the idea of forming a society to study orthodontics in England, was elected President. This is the second year that he has held office.

The year has been a very successful one. The President gave a most interesting address entitled, "Twenty Years After." The Distinguished Visitor this year was Professor J. T. Cunningham, whose paper upon the difficult and interesting subject of "Heredity" was much appreciated. Papers have been read by Mr. Lewin Payne, Mr. Cale Mathews and Mr. Visick. A number of short Communications have also been presented. The Papers and short Communications have been

discussed by twenty-one members and one vivistor, out of a total membership of approximately 200. The usual Demonstration Meeting was held in May. As in former years, this meeting was very well attended.

During the year, fourteen new ordinary members have been elected. Five members have resigned, and the news of the death of one member, Mr. G. Layton, was received with much regret. For the purposes of comparison, the previous year eight new ordinary members were elected and two resigned. The actual figure of the membership of the Society now stands at 227, as against 221 last year.

French Society's Invitation.—The Society received an invitation from the Société Française d'Orthopédie Dento-Faciale to attend their meeting in Paris on April 11th, 12th and 13th. The French Society was cordially thanked for its invitation.

The Council has given its most anxious consideration to the matter of the library and museum cabinets, presented to the Society by Messrs. Lewin, Payne and Chapman, and very greatly regret to have to report that, at the moment, it is impossible for them to be stored at the rooms of the Medical Society.

Having been received on the motion of Mr. Evans, seconded by Mr. Steadman, the report was unanimously adopted.

Motion by the Council.

The President announced that it had been approved by the Council, and now came up for confirmation at the Annual General Meeting, that Professor J. C. Brash, M.C., M.A., M.D., Ch.B., B.Sc., be elected an honorary member of the Society.

The election of Prof. Brash was confirmed by acclamation.

Presentation to Mr. Carl Schelling.

The President, addressing Mr. Schelling, said: My dear Schelling, it was felt by the Council that we could not allow your resignation as Editor after nineteen years to pass without some acknowledgment on the part of our Society. We therefore wish to present to you these tokens of esteem and gratitude.

We feel that you have deserved well of this Society, and their thanks have taken the form of this ivory and these crystal ornaments—the ivory as symbolising your activities in the world of sport as well as your scientific attainments. You will note that you have achieved one of the ambitions of your life in successfully catching and holding fish, and also, I may say, it symbolises the firm grip you have on the affections of your colleagues.

These crystals, which are birds of sorts, and very hard to carve into satisfactory form, as you no doubt well know, should typify the many lucid, though formally concise messages which you have so frequently sent to your colleagues in reference to their Communications in the past nineteen years.

I hope that you will live long to retain the memory of nineteen years well spent, and that you will frequently enjoy viewing these mementoes which your colleagues have such very great pleasure in presenting to you.

Mr. Carl Schelling: I thank you, sir, and my kind friends for the gracious way in which you have spoken and for this very tangible proof, which I shall always value, of your remembrance. I have not had the opportunity of concocting anything like the witty passages that Mr. Northcroft has given us. I hope you will not think I am unkind if I sit down after briefly expressing my thanks. I hope I shall be able to cherish these souvenirs for a long time to come.

TWO CASES IN ORTHODONTIC PRACTICE.*

By George Northcroft, O.B.E., L.D.S., D.D.S.

It once more devolves on me to relinquish the office of President of this Society and to invest my successor with his badge of office. But before doing so it seems to be expected that a few remarks should be made by way of farewell and as the session began with a technical discourse it was deemed advisable to terminate it in a like manner.

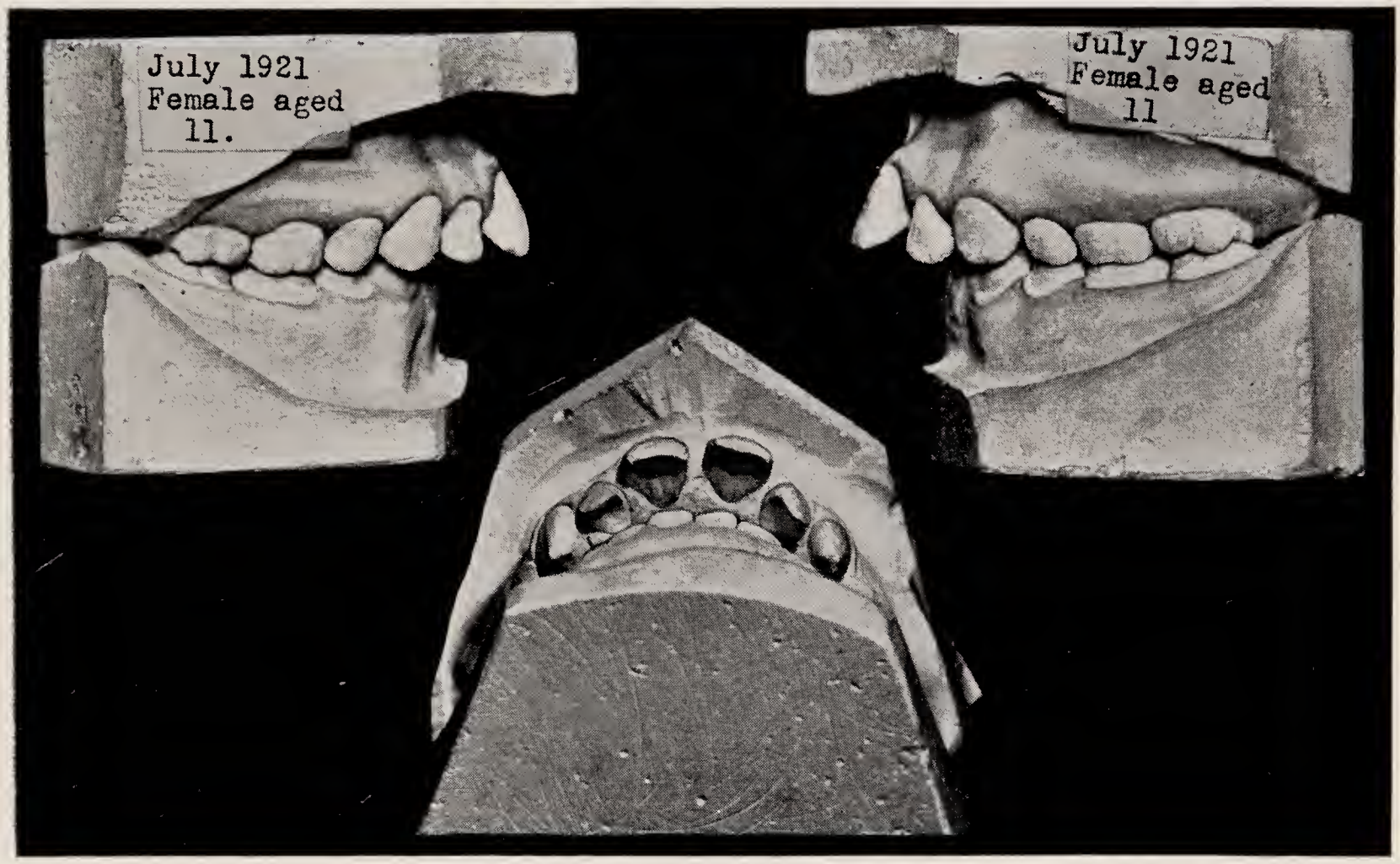


Fig. I.

It has been remarked before that almost any orthodontist of prolonged experience can produce evidence to refute almost any known theory of causation or treatemnt.

Those of you who were fortunate enough to be present at the reading of Mr. Hubert Visick's paper last month may remember his assertion that in his experience no case of post normality of the mandible had ever been successfully treated by inclined planes (only being an old Angleite he called it Class II, div. I).

Now it happened that three or four such patients have been so treated and one has been selected for you to decide whether the treatment has been successful or not. The models have already been given to the museum and therefore ought to be only too familiar to the many keen orthodontists who make up this society.

Be that as it may :—

In July, 1921, a female aged 11 came in consultation showing condition in Fig. I. An attractive child (Fig. II), of naval parents, nervous, but amenable to discipline ; went to school in the West of England, making visits other than at holiday times an impossibility.

* *Transactions* of British Society for the Study of Orthodontics.

It was explained that if the treatment proposed under these circumstances was undertaken everything depended on the intelligent co-operation of the patient, who had the choice plainly put before her of becoming a truly fascinating daughter of Eve, or remaining typical of the material used by spiteful continental caricaturists when portraying the travelling Englishwoman.

It was realised that to be successful, a forward biting plate must be what its name implies, and not a thing to be worn "except at meal times," or "at night only."

Fig. II.

The $\underline{e \mid e}$ being very loose, treatment was commenced in August, 1921 by the extraction of $\frac{e \mid e}{e \mid e}$, according to the well recognised teaching, as a first step to procure the natural forward movement of $\underline{6 \mid 6}$. This was followed in September by a biting plate with inclined plane with springs (Fig. III) to retract $\underline{4 \mid 4}$, at the same time holding back $\underline{6 \mid 6}$.

In December, 1921, three months after commencement of treatment, the mandible was no longer post-normal but considerable proclination of the maxillary incisors persisted.

In April, 1922, aged 11.9, all the premolars had erupted and locked normally, the over bite and proclination were still further reduced.

In April, 1923, a year after this, age 12.9, the $\frac{7 \mid 7}{7 \mid 7}$ had all erupted and the case was considered completed. It will be noted that the bite was opened at the physiological age of active growth in depth at the angles of the mandible. All apparatus was abandoned at the age of 13.

In November, 1929, by special request the patient now aged 19.4, allowed further models to be taken, six years after all treatment was abandoned (Fig. IV).

The moral of this case is " Strike while the iron is hot."

Another case with the same moral, that of choosing the psychological moment at which to operate, and incidentally showing how wearying waiting on nature's processes can be, is that of a female aged 8 years, who showed the condition shown in Fig. V.

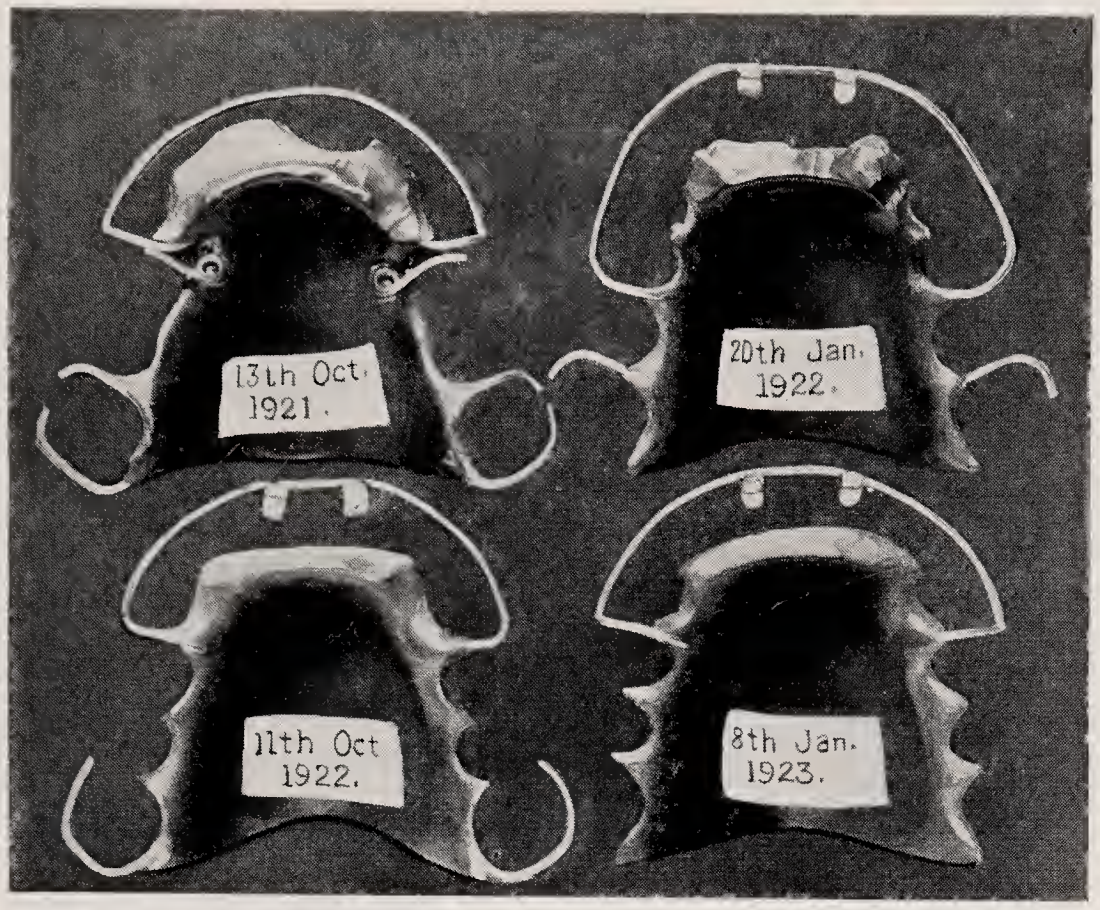


Fig. III.

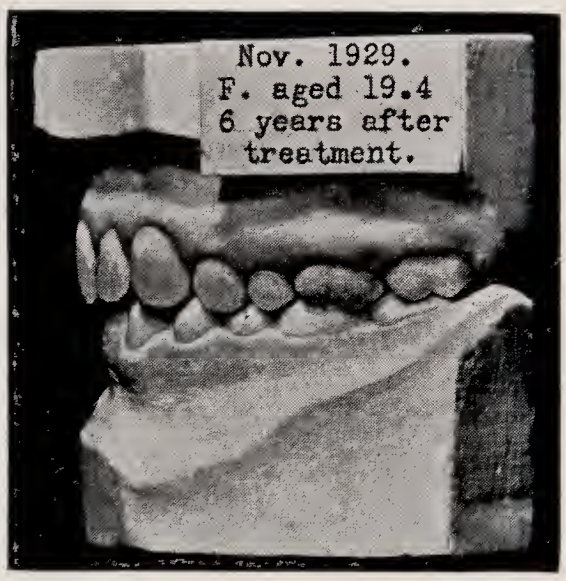


Fig. IV.

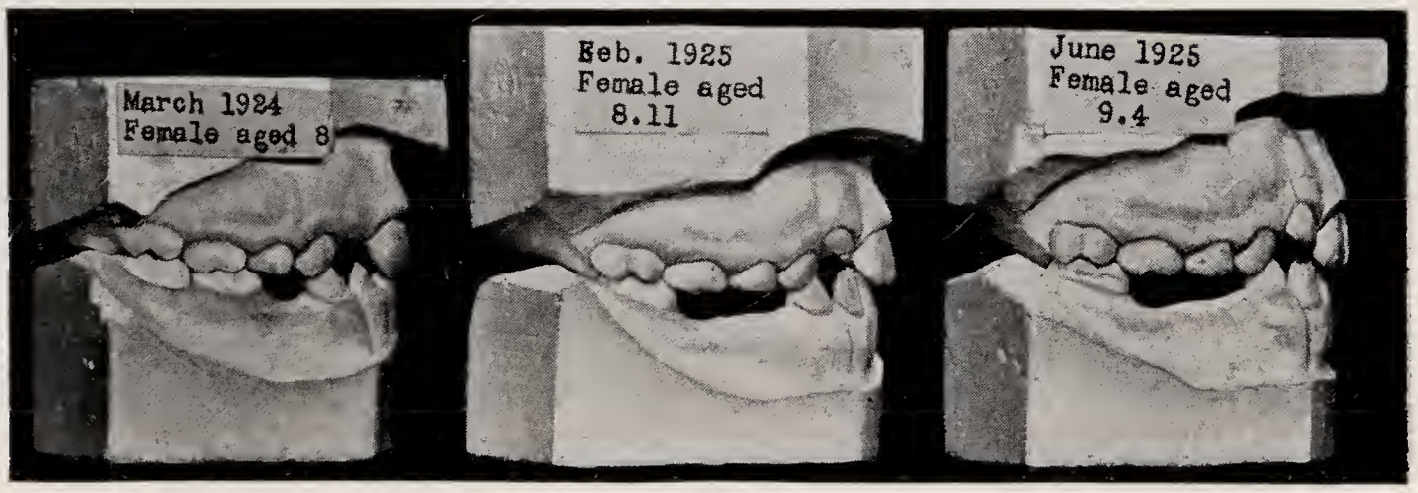


Fig. V.

At 11.7 $\overline{4}$ | had erupted in post-normal occlusion as shown in Fig. VI.

A radiograph was taken showing presence of $\overline{5}$ | unerupted (Fig. VII) and an apparatus was inserted to bring $\overline{4}$ | in contact with $\overline{3}$ |. In eight months the occlusion had been corrected, the fixed apparatus removed and a vulcanite splint inserted to increase function and stimulate eruption of $\overline{5}$ | (Fig. VIII).

The second radiograph was made two years after the first and all apparatus was abandoned. It is interesting to note that although the apex of $\overline{4}$ | has probably not moved, the evidence of tilting is extraordinarily slight.

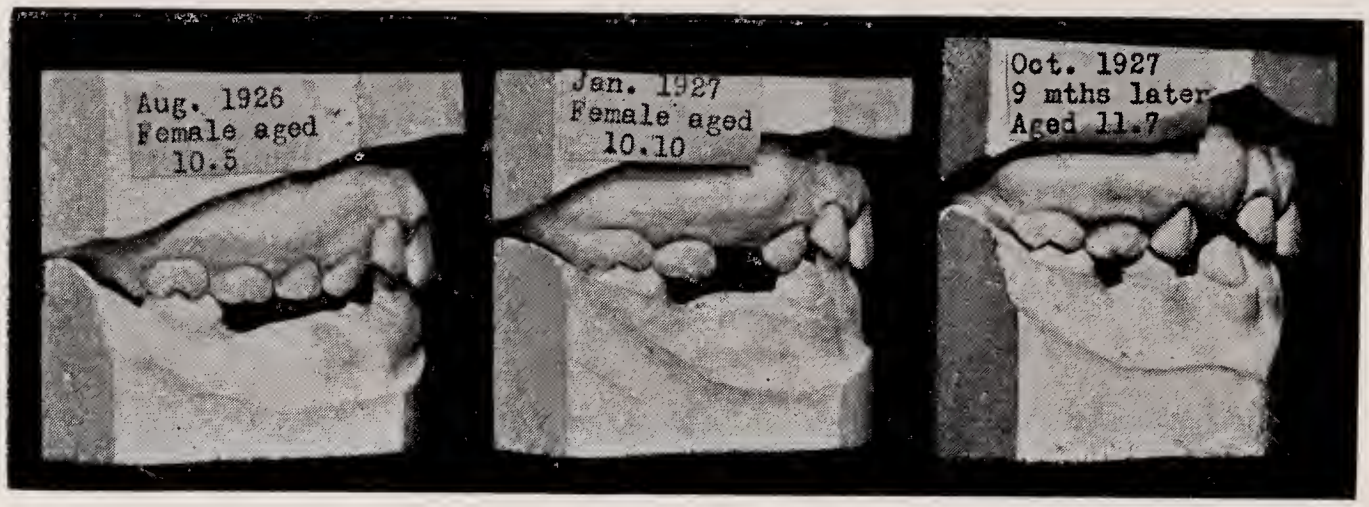


Fig. VI.

Fig. VII.

Fig. VIII.*

It is now my great pleasure to invest my successor with his badge of office and wish him and his fellow officers the greatest possible success in the coming year.

* Models (Fig. VIII) wrongly occluded by the photographer.

New President.

The President said it devolved upon him to relinquish the office of President of the Society, and to invest his successor with the badge of office. Before doing so, he was expected to make a few remarks by way of farewell, and as the session had begun with a technical discourse, he had deemed it advisable to terminate it in a like manner.

[This address, entitled "Two Cases in Orthodontics," will be found on page 79.]

Mr. Northcroft then formally inducted the President-elect into the chair.

The President, Mr. H. E. Marsh, said he wished to return his most sincere thanks to the members for electing him to the chair. It was an indication of the democratic nature of the Society that the members should have seen fit to elect a practitioner from a country town. He could assure them that there were many provincial members who looked upon the Society, as far as this country was concerned, as the very fount of orthodontic wisdom. It only remained for him to thank the readers of the papers.

Mr. Chapman said he would like, before the meeting dispersed, to voice the feeling of the rest of the members in asking them to join with him in offering a very hearty vote of thanks to Mr. Northcroft for so ably filling the presidential chair for the second time. He had concluded his year of office with two very instructive object-lessons, for which the members were deeply grateful.

The vote of thanks was carried with acclamation.

Mr. Northcroft, in reply, thanked the members for their kind expression of approval. If he had not been in such a hurry to get his successor into the chair, he would have taken the opportunity of thanking the Council and the officers, who had so ably supported him during his year of office. They deserved, indeed, far more thanks than he did, because they had done all the work to make his year of office as successful as it had been.

On the motion of Mr. H. C. Visick, a vote of thanks was accorded to the officers of the Society for their work during the past year.

The meeting terminated at 9.15 p.m.

The PRESIDENT, in calling upon Mr. Watkin for his short communication, said the members would consider it a great pleasure to have with them that evening a distinguished surgeon from Liverpool, Mr. Simpson, who performed the operation which Mr. Watkin was about to describe. He hoped Mr. Simpson would consider himself a member for the evening, and would take part in any discussion that might arise.

THE SURGICAL CORRECTION OF AN EXAGGERATED CASE OF INFERIOR PROTRUSION.

By H. G. Watkin, L.D.S. and G. C. E. Simpson, M.B., B.Ch., B.Sc.Lond., F.R.C.S.

The case I am presenting to you this evening is that of a patient aged twenty-eight who was sent to me by a colleague for consultation.

Fig. 1 shows the extreme condition of the malocclusion.

The lower incisors are 19 mm. anterior to their normal position with relation to the upper incisors. When this photograph was taken great

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care was exercised to make certain that the mandible was not protruded.

Fig. 2 is an oblique view with the jaws closed and the lips opened to show the teeth.

Fig. 3 is a side view of models of the mouth mounted on an articulator.

Fig. 4 is a front view of same. It will be observed that there are only two points of occlusion between the upper and lower jaws, viz. at the back of the mouth, and that the upper arch is smaller and inside the lower arch. The tongue is entirely inside the lower jaw.

Fig. 5 shows the lower model placed in the best possible occlusion with the upper model.

Fig. 6 shows side views of same.

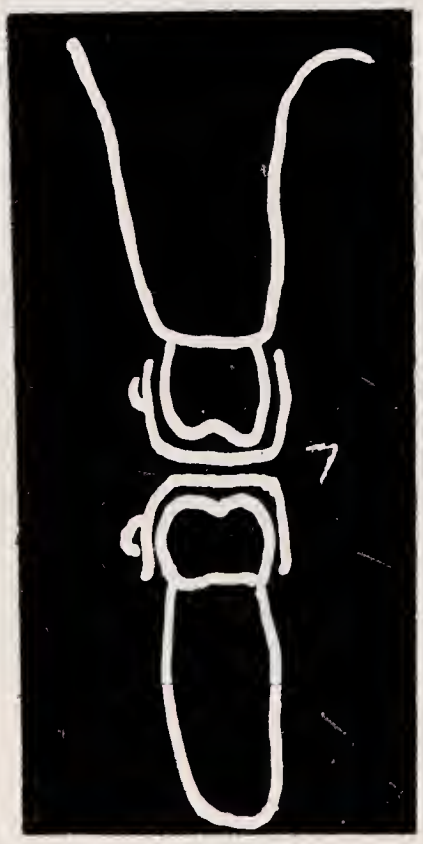


Fig. 7 illustrates a silver splint which was made. It took the form of two continuous caps to fit the crowns of the teeth of each jaw. At suitable positions hooks were placed to enable the two jaws to be wired securely together. These caps were cemented in position the day before the operation and in arranging the new occlusion the molars were gagged to the extent of about three mm. more than the incisors.

The surgical part consisted of sawing through each ramus at a point just above the dental foramen. The angle at which the saw-cut was made was considered important because, to get the teeth into the best occlusion the rami required lengthening and this could be achieved by making the cut from before backwards and downwards.

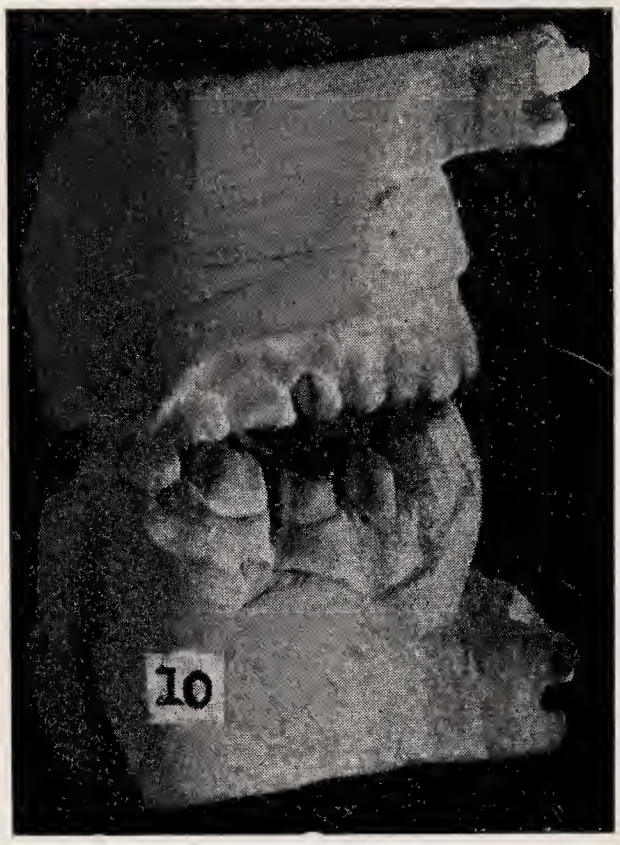
Fig. 8 makes this clear. A horizontal cut makes the ramus the same length after the operation as before, an oblique cut makes it either longer or shorter as desired.

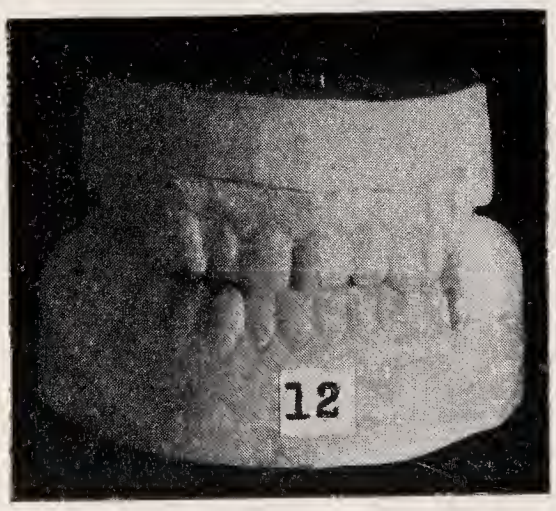
As X-ray negatives projected on the screen show very badly, I have made an outline sketch of one side after the operation—the other side is very similar. (See Fig. 9.)

The splints were removed after six weeks during which time the patient was fed on liquids sucked through a glass tube suitably bent so that one end protruded into the mouth through a gap caused by a lost molar.

After the removal of the splints it was found that in spite of the previously arranged excess gagging in the molar region the incisors would not meet.

Fig. 10 shows this.





It was obviously necessary to remove two of the posterior teeth. The upper third molars (one of which was rudimentary) were extracted and a little of the tuberosity of the maxilla was removed.

After the use of articulating paper and a little careful grinding of the teeth, the incisors were enabled to meet and sixteen teeth are now in occlusion as shown in Figs. 11, 12, and 13.

The load of the bite was thus distributed and periostitis avoided. The patient was asked to bite the operator's finger and this could be borne without much pain—showing that the muscles were rather weak. A simple form of jaw exercise was given, viz. to chew chewing-gum and after three weeks the patient remarked with a smile "*Now* let me bite your finger."

This offer was wisely refused—the operator inserting instead a thick strip of rubber which it was found impossible to remove as long as the patient was biting.

There was complete anæsthesia round the front of the mouth anterior to the mental foramina, but this was considered to be due rather to the stretching of the dental nerve than to its division and there are now signs of the return of sensation.

When the jaws were first released from the splints and the patient found he could open and close his mouth with comfort, he nearly collapsed with the shock of joy. It was noticeable that his speech was at once improved and is now normal.

Fig. 14 shows the patient's present appearance.

I have now great pleasure in asking Mr. G. C. E. Simpson to speak to you. He has been good enough to travel here from Liverpool to-day in order to give the members first-hand details of the operation.

Mr. Simpson then gave the following account of the surgical operation :—

In subcutaneous osteotomy of the mandibular ramus, a point on the posterior border about the level of the centre of the lobule of the ear should be above the facial nerve and dental foramen. The anatomy

should be checked by X-ray photographs, however, owing to the unusual obliquity of the ramus.

A fine tenotome is entered at the chosen spot and pushed on to the posterior border of the bone. A small periosteal elevator is passed along the tenotome before the latter is withdrawn and the periosteum of the deep surface of the mandible raised for the whole width. The saw is passed along the elevator and the bone cut from within outwards.

When the cut is well into the bone the final separation may be hastened by the use of a small chisel. In the case described we were agreeably surprised by the ease with which the periosteum separated.

I feel sure that on both sides we were on bone and above the dental foramen, but in spite of this there was anæsthesia—the explanation is probably due to stretching of the nerve by the displacement required in this case—the overlap on one side as shown by X-ray was only about one third of the cut edge.

Mr. Simpson added that he wished to acknowledge that the point was to him a most interesting one in surgery, and he was very pleased to be allowed to come to the meeting to support Mr. Watkin. He did not think Mr. Watkin had by any means made the most of the case, because having a somewhat natural anxiety about the possibility of non-union, he had himself inquired from the patient, who was prepared to take the risk since he could not eat in public. His mouth was so bad that he was really ashamed to take a meal in front of anyone, and in the profession he was adopting it was rather important that he should be able to do so.

In conclusion, I would like to place on record my thanks to Mr. Simpson for his kind and able co-operation. We derived some help from a description of a similar operation in the book *The First International Orthodontic Congress,* New York, 1926 (page 245). "The Surgical-Orthopædic Removal of the Deformations of the jaws." The article is by Christian Bruhn, Dusseldorf, Germany.

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Discussion.

The President remarked that the teeth being in such good condition seemed to show how much the lack of function was overstressed as causing disease, and asked if the extraction of the upper third molar and the grinding were done at the time the splints were ligatured together or at a subsequent operation.

Mr. Watkin said this was done after the splints were taken off. No gagging had been anticipated. He thought the gagging was due to the fact that the two parts of the jaw that were cut away would be slinging on the attachments, on the check ligaments, and would not be held up tightly, so that when the patient could close his mouth and the muscles put pressure on the back, they were naturally shorter there than was anticipated, although 3 mm. were allowed for that. He would allow 6 mm. next time. This, however, proved rather lucky in the end, because much better occlusion was obtained on the right side. The posterior molars were of very little use in any case.

Mr. Steadman congratulated the authors on the very brilliant operation they had described. He would like to know more about what happened to the dental nerve. In pushing the body of the mandible back, was the nerve merely stretched or was it actually torn ? It seemed possible that the distance that the larger fragment had to be pushed back was so great that the nerve might have been severed. He desired to express his admiration for the careful way in which the operation had been planned, and he thought it would encourage others to try it. Fortunately, such cases were very rare. One of the points which had impressed him most was the very small external cuts that had been made. Such an operation would not disfigure any patient.

Mr. N. Gray said he desired to ask Mr. Simpson a question. In Philadelphia he had seen a similar case, and in exactly the same way the teeth were splinted, and bands were made and cemented to the teeth before the operation.. One point that had interested him was the type of saw used—just like an ordinary fret-saw, only longer, and a needle was first threaded through the tissues, very carefully led round the bone, and the saw pulled through by it. The surgeon had cut right through in a few seconds with a to-and-fro motion. It had struck him as simply a fret-saw blade.

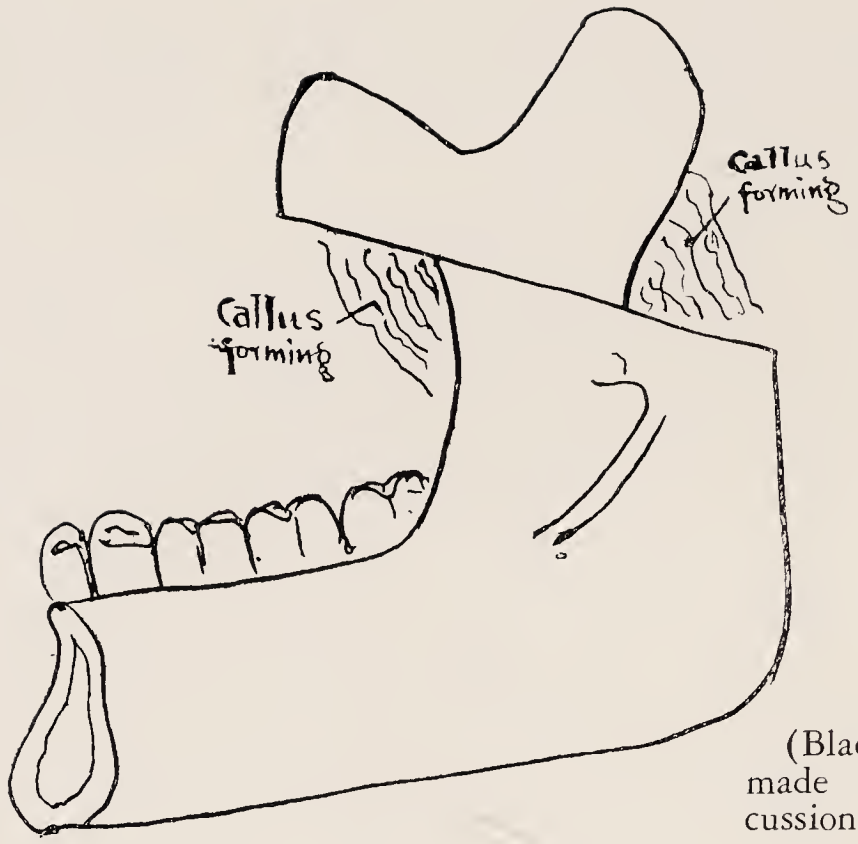
Mr. Simpson said he had thought of the Gigli saw in case of difficulty, but there are several objections—instead of having one cut only, two were needed. From his knowledge of those saws they often broke. They had to be kept true. It was most awkward unless one had a grooved guide to keep them right, to prevent their ragging the tissue.

With regard to the foramen, on one side he was not sure he was very much above it, but on the other side he was quite sure he was above it ; it seemed to him that with that enormous displacement backwards, nearly three-quarters of the width of the mandible (judging by the X-ray photograph—he would have thought it was more than the 19 mm. mentioned by Mr. Watkin) there must be a tremendous pull on the nerve across, and the fact that sensation was returning seemed to show that it was probably a nerve stretch rather than a nerve cutting.

Mr. Watkin said if the operation was possible for a prenormal occlusion, it must be that there were many possibilities for doing the reverse operation. If a patient came along with no chin, he did not see why they should not give him one. The cut could be made at a predetermined angle and the jaw splinted accordingly.

Mrs. Lindsay asked what was the present shape of the ramus, and whether it followed the usual laws of growth, absorption and deposition, and what happened to the posterior rim of the part that was pushed back—was it moulded back into line again, or did it project backwards ?

Mr. Watkin said it projected backwards, but there were signs of callus all round the junction. As a matter of fact, the patient rather unwisely had gone to the skating rink, and had fallen over and had several knocks on his jaws, without any trouble resulting.



(Blackboard diagram made during the discussion.)

Mr. HIGHTON said he could not criticise the surgical side, but he had been interested to see that the teeth appeared to be in a good condition, in spite of the fact that before the operation there was no occlusion.

The Hon. Secretary (Mr. PACKHAM) said he wanted to thank Mr. Watkin and Mr. Simpson very much for showing the case. He had made one or two notes, and it was curious that he had thought of exactly the same thing as Mr. Watkin had just mentioned—how useful it would be if one could only treat the post-normal cases in the same way as he had treated his pre-normal case.

He desired to ask Mr. Watkin as to the man's voice—whether his voice was affected, and to what degree, and particularly whether there was any difficulty in articulating his s's. He would have been very grateful if he could have seen the man before the operation, and to hear him say the word "scissors." He had a case under his own care at hospital at the present moment, and it was giving him very great anxiety. The trouble in this case was chiefly not because the girl could not eat, but because her speech was so badly affected that she wished something done. Her s's were particularly bad.

He also wished to ask Mr. Watkin how long the splint was kept on, and whether the two jaws were tied together tightly for all the length of time the splint was kept on.

Another point which was exercising his mind was that it would be interesting to test whether the teeth gave their normal reactions to heat and cold in the lower jaw. That would give some indication of what had happened to the inferior dental nerve on each side.

In conclusion, he desired to congratulate the two gentlemen concerned upon such a successful issue.

Mr. WATKIN said he had already mentioned that the speech was greatly improved. He thought the "s" was the greatest difficulty before. He used the word "sausage" or "Cissie." "Scissors" was rather a good word. The patient could speak quite clearly afterwards.

Mr. PACKHAM asked whether Mr. Watkin could assure him that the patient could say "scissors" now.

Mr. WATKIN replied that the patient was now able to pronounce the word "scissors" absolutely perfectly. The splints had been kept on, firmly fastened, for six weeks, to allow the bone to unite firmly. The operation was on a Tuesday, and the splints had been taken off on the Saturday before the expiration of the six weeks. There was no question that the bones had all grown together quite properly.